STAR

A SEMIMONTHLY ABSTRACT JOURNAL WITH INDEXES

DECEMBER 8, 1971

VOLUME 9 • NUMBER 23

N71-36398—N71-37592

PUBLIC DOCUMENTS

JAN 5 1972

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PUBLISHED BY:
UNITED STATES GOVERNMENT
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
SCIENTIFIC AND TECHNICAL INFORMATION OFFICE
Scientific and Technical Aerospace Reports, Volume 9, is prepared by the NASA Scientific and Technical Information Facility operated for the National Aeronautics and Space Administration by Informatics Tisco, Inc.

Use of funds for printing this publication approved by the Director of the Office of Management and Budget March 11, 1971.

SPECIAL NOTICE

Replacement of the COSATI Microfiche Standard

As a result of a decision reached by the Federal Council for Science and Technology all Federal Government agencies currently producing microfiche at the 20:1 reduction ratio (60-frame format) will adopt the 24:1 reduction ratio (98-frame format) using the standard of the National Microfilm Association (NMA). The imagery on fiche produced by the NMA standard will be approximately 25% smaller than the imagery on COSATI microfiche.

It is anticipated that the change-over ultimately will enable recipients of fiche to work with one common, low-reduction format for all nationally and most internationally produced microfiche. The 98-frame format increases the probability of having a complete document on one fiche. Also this should allow manufacturers to concentrate their developmental efforts on fiche equipment geared to a single format.

This change will result in only a negligible effect on most users. There should be no effect in the area of fiche duplication. Where readers and reader-printers are concerned, a slightly reduced blowback will be experienced with 18X to 20X lenses. However, automatic enlarger-printers geared to the 60-frame format will have to be modified or replaced in order to accommodate the 98-frame format.

The major fiche producing agencies will implement the change as resources permit.

SPECIAL NOTICE

Replacement of the COSATI Microfiche Standard

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The major fiche producing agencies will implement the change as resources permit.

INTRODUCTION

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STAR is a comprehensive abstracting and indexing journal covering current worldwide *report* literature on the science and technology of space and aeronautics. Publications abstracted in *STAR* include scientific and technical reports issued by NASA and its contractors, other U.S. Government agencies, and corporations, universities, and research organizations throughout the world. Pertinent theses, NASA-owned patents and patent applications, translations, and other separate documents are also abstracted. Citations and abstracts in *STAR* are grouped in 34 subject categories. Five indexes are included in each issue: subject, personal author, corporate source, contract number, and report/accession number. Cumulative index volumes are published semiannually and annually.

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The Preliminary Edition of the *NASA Thesaurus* (December 1967) (NASA SP-7030) is used as the authority for the indexing vocabulary that appears in the subject index. The *NASA Thesaurus* should be consulted in examining the current indexing vocabulary, including associated cross-reference structure. Only the subject terms that have been selected to describe the documents abstracted in this issue appear in the subject index. Copies of the *NASA Thesaurus* may be obtained from the National Technical Information Service or the U.S. Government Printing Office at $8.50 for the three-volume set.

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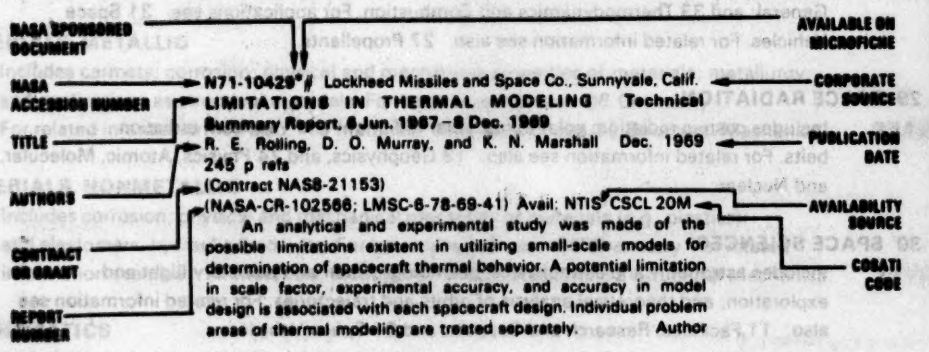
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LIMITATIONS IN THERMAL MODELING Technical Summary Report, 6 Jun. 1967 – 8 Dec. 1969
R. E. Rolling, D. O. Murray, and K. N. Marshall Dec. 1969
PUBLICATION DATE
245 p refs
AUTHORS
(Contract NAS8-21153)
(NASA-CR-102566; LMSC-6-78-69-41) Avail: NTIS CSCL 20M
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An analytical and experimental study was made of the possible limitations existent in utilizing small-scale models for determination of spacecraft thermal behavior. A potential limitation in scale factor, experimental accuracy, and accuracy in model design is associated with each spacecraft design. Individual problem areas of thermal modeling are treated separately. Author
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VOLUME 9 NUMBER 23 / DECEMBER 8, 1971

Scientific and Technical Aerospace Reports

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01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N71-36398*# Translation Consultants, Ltd., Arlington, Va.
RELATION BETWEEN STRATOSPHERE TURBULENCE CAUSING AIRCRAFT BUFFETING AND THE VERTICLE DISTRIBUTION OF METEOROLOGICAL PARAMETERS [SVYAZ TURBULENTNOSTI V STRATOSFERE, VYZYVAY-USHCHEY BOLTANKU SAMOLETOV, S VERTIKALNYM RASPREDELENIYEM METEOROLOGICHESKIKH PARA-METROV]
G. S. Buldovskiy Washington NASA Oct. 1971 18 p refs Transl. into ENGLISH from Gidrometeoizdat (USSR), no. 70 1970 p 79-92
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The relation between aircraft buffeting of various intensities and the vertical distribution of meteorological parameters calculated from radiosonde data is determined. In this case the main problem reduces to finding the critical values of these parameters, which optimally characterize the successfulness of a diagnosis of the presence or absence of aircraft buffeting. It is found that the successfulness of such diagnosis is optimally characterized by the vertical wind vector shear, the Richardson number, and the change in thermal stability from the underlying to the overlying layer (a change which characterizes the boundaries of the baroclinic layers). On the basis of a graph of the dependence of aircraft buffeting on a combination of two of these factors, a buffeting parameter is obtained in terms of which a condition governing the presence or absence of buffeting is expressed. Author

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A. E. Billington Jan. 1971 7 p refs
(ARL/SM-Note-360) Avail: NTIS

It is shown that the so-called leading edge suction of thin aerofoil theory is a misnomer. It results from misinterpreting the meaning of the leading edge singularity. Author

N71-36400# Advisory Group for Aerospace Research and Development, Paris (France). Ad Hoc Committee.
ENGINE-AIRPLANE INTERFERENCE AND WALL CORRECTIONS IN TRANSONIC WIND TUNNEL TESTS
Aug. 1971 143 p refs
(AGARD-AR-38-71) Avail: NTIS

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1. CONCLUSIONS AND RECOMMENDATIONS ON ENGINE AIRPLANE INTERFERENCE AND WALL CORRECTIONS IN TRANSONIC WIND TUNNEL TESTS A. Ferri 5 p (See N71-36401 23-01)
2. ENGINE-AIRPLANE INTERFERENCE IN TRANSONIC TESTS F. Jaarsma 117 p refs (See N71-36402 23-01)
3. WALL CORRECTIONS FOR AIRPLANES WITH LIFT IN TRANSONIC WIND TUNNEL TESTS R. Monti 15 p refs (See N71-36403 23-01)

N71-36401# Advisory Group for Aerospace Research and Development, Paris (France).
CONCLUSIONS AND RECOMMENDATIONS ON ENGINE AIRPLANE INTERFERENCE AND WALL CORRECTIONS IN TRANSONIC WIND TUNNEL TESTS
Antonio Ferri (New York Univ., N. Y.) *In its* Eng.-Airplane Interference and Wall Corrections in Transonic Wind Tunnel Tests Aug. 1971 5 p (See N71-36400 23-01)
Avail: NTIS

The conclusions and recommendations are presented concerning the correct representation in wind tunnel tests of the interaction between engine flow and airplane characteristics, and wall interference at high lift. A review of experimental methods in use for determining engine-airplane interference in transonic tests includes the following topics: (1) inlet airplane interference, (2) engine thrust with airplane drag and nozzle characteristics, (3) exhaust flow and airplane interference, and (4) determination of interference of the engine flow on the aerodynamic characteristics of the complete configuration. It is concluded that all of the approaches have important unknowns and shortcomings; action is required by research groups to develop new techniques, and improve existing ones. F.O.S.

N71-36402# Advisory Group for Aerospace Research and Development, Paris (France).
ENGINE-AIRPLANE INTERFERENCE IN TRANSONIC TESTS
F. Jaarsma (Natl. Aero- and Astronaut. Res. Inst.) *In its* Eng.-Airplane Interference and Wall Corrections in Transonic Wind Tunnel Tests Aug. 1971 117 p refs (See N71-36400 23-01)
Avail: NTIS

A compilation is presented of the responses to a distributed questionnaire on engine-airframe interference in transonic tests among aeronautical laboratories operating transonic wind tunnels, aircraft manufacturers, engine companies, and airplane

users in the AGARD countries. The experimental techniques, correction procedures, advantages and limitations of inlet, nozzle/afterbody, complete model testing, and engine thrust determination are discussed in a technical order. Author

N71-36403# Advisory Group for Aerospace Research and Development, Paris (France).
WALL CORRECTIONS FOR AIRPLANES WITH LIFT IN TRANSONIC WIND TUNNEL TESTS
R. Monti (Univ. Degli Studi, Naples, Italy) *In its* Eng.-Airplane Interference and Wall Corrections in Transonic Wind Tunnel Tests Aug. 1971 15 p refs (See N71-36400 23-01)
Avail: NTIS

The technical information supplied by the Ad Hoc Committee is summarized. After some preliminary remarks on wall interference corrections in transonic tests, the different answers to the AGARD questionnaire are presented together with the main points made by the committee members as representatives of the different countries. A number of general agreements among the committee members are stated which indicate the state-of-the-art of transonic wind tunnel corrections. The discussions and the conclusions of the committee are presented on the problems which appear to be most important for future research. Problems are briefly reviewed and research areas are indicated for which the committee agreed an international program will be most profitable. A list of references is provided which includes the works referenced by all the different groups participating in the committee. Author

N71-36404*# United Aircraft Corp., East Hartford, Conn.
ANALYTICAL INVESTIGATION OF THE EFFECTS OF BLADE FLEXIBILITY, UNSTEADY AERODYNAMICS, AND VARIABLE INFLOW ON HELICOPTER ROTOR STALL CHARACTERISTICS
E. D. Bellinger Washington NASA Sep. 1971 114 p refs
(Contract NAS1-8350)
(NASA-CR-1769) Avail: NTIS CSCL 01C

An analytical study was conducted to investigate systematically the relative importance of blade flexibility, unsteady aerodynamics, and variable inflow (with and without wake distortions) in determining predicted helicopter rotor stall characteristics. The theoretical results of this study were compared with a corresponding full scale wind tunnel results for the H-34 rotor system. The classical theory (rigid blades, steady aerodynamics, and constant inflow) produced good correlation at nominally unstalled operating conditions. However, rotor lifts significantly lower than the test values were predicted at high blade angles of attack. The use of unsteady airfoil data provided the most significant improvement in correlation by allowing higher section lift coefficients to be reached due to the stall delay phenomenon associated with unsteady operating conditions. The primary effect of blade flexibility was due to blade torsional deflections, which, as with blade pitch changes, had a direct effect on performance. Variable inflow, although producing significant changes in the angle of attack distribution over the disc, did not appreciably affect rotor performance.
Author

N71-36405# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing
ANALYTICAL AND NUMERICAL STUDIES OF DOWNWASH OVER RECTANGULAR PLANFORMS
H. C. Garner (RAE) and G. F. Miller May 1971 28 p refs
(NPL-MA-89) Avail: NTIS

The distribution of downwash at the surface of rectangular planforms with prescribed subsonic aerodynamic loading is considered. Three separate aspects of the problem are treated analytically, the results of each being tested against those derived from an accurate numerical procedure. Asymptotic expressions for large and small aspect ratio are formulated and shown to apply over a wide range of aspect ratio. Downwash routines from certain existing lifting-surface methods are studied, and their patterns of convergence are illustrated and compared. A logarithmic singularity near the leading tip corner is identified, but it is observed that this can exist without serious detriment to the lifting-surface methods. Author (ESRO)

N71-36406# Rochester Applied Science Associates, Inc., N.Y.
AN EXPERIMENTAL STUDY OF TIP VORTEX MODIFICATION BY MASS FLOW INJECTION Final Technical Report, 1 Feb. 1969 - 31 Jan. 1971
Stephen A. Rinehart, John C. Balcerak, and Richard P. White, Jr. Jan. 1971 85 p refs
(Contract N00014-69-C-1069)
(AD-726736; RASA-71-01) Avail: NTIS CSCL 20/4

An experimental program was conducted to investigate the modifications of a tip vortex which could be obtained by injecting the core of a tip vortex with a stream of air. Wind tunnel tests of an airfoil model were conducted. The results obtained from flow-visualization studies, balance data, and vortex-meter measurements show how the strength of the tip vortex can be reduced significantly by the injection of a linear mass flow of air into the core of the tip vortex. The reduction in drag obtained with injection is important since it allows the recovery of power required to inject the tip vortex core with mass flow. Author (GRA)

N71-36407# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
CALCULATION OF LIFT INTERFERENCE CORRECTIONS DUE TO WIND TUNNEL TEST SECTION BOUNDARIES BY THE VORTEX LATTICE METHOD Annual Report, 1 Apr. 1970 - 31 Mar. 1971
E. Wasserstrom, Y. Borovik, D. Hazanovsky, and J. Rom Apr. 1971 44 p refs
(TAE-124; Rept-160-088) Avail: NTIS

The vortex lattice numerical method is used to calculate lift interference corrections due to wind tunnel test-section boundaries. Various test-section geometrical shapes are considered, such as square, rectangular and circular. The calculations were carried out for closed, partially open and completely open (free-jet) test sections respectively. The model is represented mathematically by a simple horseshoe vortex. Spanwise as well as longitudinal variations of the normal induced velocity at the model are determined. The resulting interference parameters agree with available exact theoretical calculations. Author

N71-36408# ARO, Inc., Arnold Air Force Station, Tenn.
TESTS CONDUCTED IN THE AEDC 16-ft TRANSONIC TUNNEL ON A 0.0226-SCALE MODEL OF THE C-5A AIRCRAFT FOR DATA CORRELATION BETWEEN THREE TRANSONIC WIND TUNNELS Final Report, 30 Dec. 1968 - 20 Jan. 1970
J. A. Black AEDC Jul. 1971 64 p refs
(Contract F40600-72-C-0003)
(AD-727006; AEDC-TR-71-105; ARO-PWT-TR-71-88) Avail: NTIS CSCL 14/2

Tests were conducted on two configurations of a 0.0226-scale model of the C-5A aircraft for the purpose of data correlation with other major transonic test facilities. The results reported herein were obtained at Mach numbers from 0.600 to 0.825 and Reynolds numbers from 2.1 million to 4.2 million and represent the AEDC contribution to the correlation study.
Author (GRA)

N71-36409# Texas Univ., Austin. Applied Mechanics Research Lab.
SUPERSONIC AIRFOILS OF MINIMUM TOTAL DRAG
Don James Hull Dec. 1970 35 p refs
(Grant AF-AFOSR-1744-69)
(AD-726767; TR-1020; AFOSR-71-1958-TR) Avail: NTIS CSCL 20/4

Minimum drag airfoil shapes in supersonic flow for a given chord length are considered. The shapes are assumed to be

two-dimensional and symmetric. In order to relate the drag of the airfoil to its geometry, it is assumed that the airfoil is slender. The boundary layer is specified to be entirely turbulent. Two cases are solved: (a) minimum drag shape for a given chord and (b) minimum drag shape for a given chord and heat transfer rate. For each case, the minimal shape is obtained by employing the calculus of variations in one independent and dependent variable to the drag expression. Author (GRA)

N71-36410# National Research Council of Canada, Ottawa (Ontario).
COMPARISON OF THIN PLATE AND THICK AEROFOIL BLADES IN A CENTRIFUGAL FAN
H. S. Fowler Aug. 1971 33 p refs
(ME-238; NRC-12166) Avail: NTIS

The patterns and stability of the airflow in the rotor of a centrifugal fan have been studied, with thin plate blading and with thick aerofoil blades. Specifications of the blading are presented, and a detailed comparison is made of the visualized flow patterns in the channels, exit velocity profiles, flow characteristic curves, and operating range. It is concluded that the aerofoil blading has a wider operating range, and some explanations of this are derived from study of the flow patterns. Author

N71-36411*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A METHOD FOR CALCULATING THE AERODYNAMIC LOADING ON WING-BODY COMBINATIONS AT SMALL ANGLES OF ATTACK IN SUPERSONIC FLOW
Charles M. Jackson, Jr. and Wallace C. Sawyer Oct. 1971 32 p refs
(NASA-TN-D-6441; L-7822) Avail: NTIS CSCL 20D

This report describes a theoretical method for estimating the aerodynamic loading on a wing-body configuration. In order to provide a basis for evaluation of the method, experimental measurements of surface pressures, forces, and moments were made on a series of basic wing-body configurations over a Mach number range from 2.5 to 4.5. Comparison of the theoretical estimates with these experimental data generally indicated good agreement for the entire range of configurations and test conditions. Author

N71-36412*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PERFORMANCE OF CLOSELY SPACED TWIN-JET AFTERBODIES WITH DIFFERENT INBOARD-OUTBOARD FAIRING AND NOZZLE SHAPES
Edwin E. Lee, Jr. and Jack F. Runckel Washington Sep. 1971 151 p refs
(NASA-TM-X-2329; L-7758) Avail: NTIS CSCL 01A

Thrust-minus-drag forces and pressure distributions were obtained on the afterbody and nozzle sections of various fuselage closures at Mach numbers from 0.60 to 2.01. Four interfairing contours were investigated: a circular-arc; an elliptical; and a blunt configuration, all ending at the nozzle attachment station; and one blunt-based type extending between the nozzles. Also, limited data were obtained with tail booms of circular or oval cross section extending from the sides of the afterbody past the nozzles. Propulsive nozzle shapes represented variable geometry iris and convergent-divergent types with circular arc and conical boattailing, respectively. Each was configured for minimum and maximum throat area (dry and augmented power) and operated with compressed air at pressure ratios up to 20, depending on Mach number. Author

N71-36413*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN IMPROVED METHOD FOR CALCULATING SUPERSONIC PRESSURE FIELDS ABOUT BODIES OF REVOLUTION
Robert J. Mack Washington Oct. 1971 34 p refs
(NASA-TN-D-6506; L-7873) Avail: NTIS CSCL 01A

An improved near-field method for determining supersonic-flow-field properties about a body of revolution is presented and discussed. Comparisons between the improved method, Whitham's theory, and wind-tunnel results are shown for four bodies of revolution - three closed-nose bodies and one ducted body. At Mach numbers of 2.86, 3.83, and 4.63 and ratios of radial distance to body length of 1.0, 2.0 and 5.0, results show that the improved method does reasonably well in predicting flow-field pressure signatures and represents a definite improvement over existing near-field theory. It is also shown that the simple area balancing shock prediction technique works reasonably well for bodies with pointed nose sections provided the improved method is used to locate the body flow-field disturbance more exactly. Author

N71-36414*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL INVESTIGATION OF A LOW REYNOLDS NUMBER PARTIAL ADMISSION SINGLE STAGE SUPERSONIC TURBINE
Louis J. Goldman Washington Oct. 1971 22 p refs
(NASA-TM-X-2382; E-6380) Avail: NTIS CSCL 01A

Turbine performance characteristics were obtained for a single stage partial-admission supersonic turbine operating at low Reynolds numbers. The turbine was tested over a range of pressure ratios from 20 to 150 and equivalent speeds from 20 to 100 percent of design. Author

N71-36415*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LONGITUDINAL AERODYNAMIC CHARACTERISTICS AT MACH 1.50 TO 4.63 OF A MISSILE MODEL EMPLOYING VARIOUS CANARDS AND A TRAILING EDGE FLAP CONTROL
Charles D. Trescot, Jr. Washington Oct. 1971 113 p refs
(NASA-TM-X-2367; L-8163) Avail: NTIS CSCL 01A

An investigation was made in a unitary plan wind tunnel to determine the static longitudinal stability and control characteristics of a missile configuration with cruciform delta wings and various horizontal canards. The controls consisted of three different trapezoidal canards and a wing trailing-edge flap located on the horizontal wings only. The tests were made at Mach numbers from 1.50 to 4.63, through an angle-of-attack range from about -4 to 30 deg, at an angle of sideslip of 0 deg, and at a Reynolds number of 8,200,000 per meter. The results are summarized in the form of various pertinent aerodynamic parameters as a function of Mach number. Although no detailed analysis of the results was made, the summary of results is useful in demonstrating the importance of certain parameters and should be useful in providing a source of systematic experimental data for correlation with analytical techniques. Author

N71-36416*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CALCULATED PRESSURE DISTRIBUTIONS AND COMPONENTS OF TOTAL-DRAG COEFFICIENTS FOR 18 CONSTANT-VOLUME, SLENDER BODIES OF REVOLUTION AT ZERO INCIDENCE FOR MACH NUMBERS FROM 2.0 TO 12.0, WITH EXPERIMENTAL AERODYNAMIC CHARACTERISTICS FOR THREE OF THE BODIES
Louis S. Stivers, Jr. Washington Oct. 1971 99 p refs
(NASA-TN-D-6536; A-4006) Avail: NTIS CSCL 20D

The pressure distributions and drag coefficients of 18 constant length and volume, slender bodies of revolution at zero incidence were calculated for Mach numbers 2.0 to 12.0. Four bodies were selected from each of four families of profiles: the Sears-Haack, the parabolic arc, the Von Karman, and one of Miele's. A 3/4-power body and a cone body were included to complete the group. Experimental aerodynamic characteristics for two Sears-Haack bodies and the 3/4-power body were obtained

from tests in the Ames 3.5-foot hypersonic wind tunnel at Mach numbers of 5.4, 7.4, and 10.5. The calculations showed that the Sears-Haack bodies generally provided the least drag throughout the range of Mach numbers from 2.0 to 12.0. The experimental aerodynamic characteristics of the three bodies showed that the overall lift and drag characteristics did not differ markedly, but that the minimum-drag coefficients were the least for the Sears-Haack bodies. The centers of pressure for the three bodies were roughly approximated by the centers of projected plan area of the bodies. Author

N71-38417*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A COMPUTER PROGRAM TO DETERMINE RADIATING, NONADIABATIC, INVISCID FLOW OVER A BLUNT BODY BY THE METHOD OF INTEGRAL RELATIONS
Frances W. Taylor Washington Oct. 1971 164 p refs
(NASA-TM-X-2328; L-7807) Avail: NTIS CSCL 20D

A computer program (Langley program D1250) has been developed in support of the study of the radiating, nonadiabatic, inviscid flow properties (pressure, temperature, density, velocities, and enthalpy) around a blunt body in equilibrium air by use of a modified method of integral relations. This report describes the digital computer program including the methods used in the digital approximation, flow charts, D1250 program code, instructions for the user, and a test case with input and output listings. Author

N71-38418*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PREDICTION OF CENTERLINE SHOCK-LAYER THICKNESS AND PRESSURE DISTRIBUTION ON DELTA WING-BODY CONFIGURATIONS
George E. Kastari Washington Oct. 1971 22 p refs
(NASA-TN-D-6550; A-4013) Avail: NTIS CSCL 20D

Methods are presented to calculate both the shock inclination angle and the surface pressure coefficient in the vertical plane of symmetry of bodies at angle of attack. The methods are applicable over an angle-of-attack range from 0 deg to a maximum angle that depends on the body slenderness ratio; for very slender bodies, this maximum angle of attack approaches 90 deg. The methods apply to configurations of elliptical cross section and of rectangular cross section with rounded corners. Author

N71-38419# Air Force Academy, Colo. Frank J. Seiler Research Lab.
THE RAM-WING SURFACE EFFECT VEHICLE COMPARISON OF ONE DIMESIONAL THEORY WITH WIND TUNNEL AND FREE FLIGHT RESULTS
Roger W. Gallington, Mark K. Miller, and Woodrow D. Smith 29 Oct. 1971 38 p refs
(AD-727774; SRL-TR-71-0012) Avail: NTIS CSCL 01/3

The one-dimensional channel flow theory with leakage is described. Using this theory lift and drag laws for low aspect ratio ram-wings with side plates are derived. The one-dimensional channel flow theory is corroborated by wind tunnel tests of two ram-wings of significantly different geometry. Lift/drag ratios far superior to existing surface effect vehicles were measured. A series of successful free flight model tests show that complete vehicles designed from the one-dimensional channel flow theory can be statically and dynamically stable over a ground clearance range from zero to infinity. Author (GRA)

N71-38420*+ National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 8)
Aug. 1971 168 p refs
(NASA-SP-7037(08)) Avail: NTIS CSCL 01B

This supplement to Aeronautical Engineering - A Special Bibliography(NASA SP-7037) lists 540 reports, journal articles, and other documents originally announced in July 1971 in Scientific and Technical Aerospace Reports (STAR) or in International Aerospace Abstracts (IAA). The coverage includes documents on the engineering and theoretical aspects of design, construction, evaluation, testing, operation, and performance of aircraft (including aircraft engines) and associated components, equipment, and systems. It also includes research and development in aerodynamics, aeronautics, and ground support equipment for aeronautical vehicles. Each entry in the bibliography consists of a standard bibliographic citation accompanied by an abstract. The listing of the entries is arranged in two major sections, IAA Entries and STAR Entries in that order. The citations and abstracts are reproduced exactly as they appeared originally in IAA or STAR, including the original accession numbers from the respective announcement journals. This procedure, which saves time and money, accounts for the slight variation in citation appearances. Three indexes - subject, personal author, and contract number - are included. Author

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N71-38421*# Aeronautical Research Associates of Princeton, Inc., N.J.
SINGLE-DEGREE-OF-FREEDOM ROLL RESPONSE DUE TO TWO-DIMENSIONAL VERTICAL GUSTS
John C. Houbolt and Asim San Jul. 1971 17 p refs
(Contract NAS1-9200)
(NASA-CR-111986; ARAP-160) Avail: NTIS CSCL 01A

The single-degree-of-freedom of roll response due to encountering vertical gusts which are random in the spanwise direction as well as the flight direction is studied. Cross spectral functions associated with the von Karman spectral function are used to evaluate the roll response. Results analogous to the results that apply in the case of vertical motion response only are found. It is shown that the wing tip acceleration due to roll for the two-dimensional turbulence case can be greater than the vertical acceleration that is found for the vertical motion reference case. An interesting possible means for evaluation of gust severity sigma sub w and turbulence scale L from vertical and rolling accelerations only is developed. Author

N71-38422*# Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.
AERODYNAMIC SOUND RADIATION FROM LIFTING SURFACES WITH AND WITHOUT LEADING-EDGE SERRATIONS
Alan S. Hersh and Richard E. Hayden [1971] 101 p refs
(Contract NAS2-5974)
(NASA-CR-114370) Avail: NTIS CSCL 01A

A series of fundamental studies were conducted to understand how lifting surfaces radiate sound in both smooth and turbulent flow. The application of leading edge serrations as a device for reducing the sound radiated from these surfaces was studied for the case of smooth inflow. The directivity pattern radiated by a small airfoil in flow was compared with that predicted by Curle's point dipole sound theory, and was found to be sufficient to present a partial check on that aspect of his theory. A theoretical model predicting the sound radiated from a small airfoil in turbulent flow shows good agreement with experiment over a wide speed range. The good agreement between theory and experiment suggests that for small airfoils in turbulent flow, most of the radiated sound is generated by the time derivative of the fluctuating lift induced by the turbulent flow. Author

N71-38423*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A NUCLEAR POWERED AIR CUSHION FREIGHTER FOR THE 1980'S
J. L. Anderson 1971 32 p refs Presented at the Am. Nucl. Soc. Winter Meeting, Miami Beach, Fla., 17-21 Oct. 1971
(NASA-TM-X-67876; E-6434) Avail: NTIS CSCL 13J

A design for a transoceanic, dry cargo-carrying freighter is suggested; its use and operation in port are discussed. With a gross weight of 4500 metric tons (5000 tons), more than 50 percent of which is cargo, it will cruise at 50 meters per second (100 knots) in waves 2.4 meters (8 ft) high. Its peripheral jet-flexible skirt air cushion concept and air thrustors will let the freighter go over waves 8 meters high at reduced velocity. Power comes from a 1280 megawatt, helium-cooled thermal reactor. It could dock at any major port in the world, but because it needs no surface contact, it could also travel inland to land-locked ports. A modular terminal design and methods of cargo transfer are suggested. The concept of cargo containerization influences both the freighter and terminal design. Author

N71-38424*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY TESTS OF THE MIXER NOZZLE CONCEPT FOR REDUCING BLOWN FLAP NOISE
Jack H. Goodykoontz, William A. Olsen, and Robert G. Dorsch [1971] 11 p
(NASA-TM-X-67938; E-6617) Avail: NTIS CSCL 01A

Noise measurements were made with a small scale external blown flap model using the mixing nozzle concept to reduce the velocity impingment at the flaps. To simplify the apparatus the mixer nozzle was simulated by a multi-lobed orifice plate. A comparison was made of the data obtained with a single orifice and an eight lobe orifice, both having the same total area of discharge. Results show that noise was reduced about 6 db below the wing when the flaps were blown with the multi-element orifice. Author

N71-38425# Cranfield Inst. of Technology (England). Coll. of Aeronautics.
THE FEASIBILITY OF THE LARGE FREIGHT AIRSHIP
D. Howe Mar. 1971 49 p refs
(Rept-5) Avail: NTIS

The reasons for the current interest in airships are analyzed and certain proposals critically examined. Some indication of the performance requirements for a large freight airship are given and the optimum speed for maximum work capacity is established. A discussion of the likely design features of the craft is concluded by selection of a particular example for numerical comparison. This is a 1000 ton gross displacement airship which in one version employs a novel method for overall control of displacement. Author

N71-38426*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SUBSONIC CHARACTERISTICS OF A TWIN-JET SWEPT-WING FIGHTER MODEL WITH LEADING EDGE KRUEGER FLAPS
Edward J. Ray and Julian G. Carmichael, Jr. (McDonnell Douglas Corp., St. Louis, Mo.) Washington Oct. 1971 69 p refs
(NASA-TM-X-2325; L-7804) Avail: NTIS CSCL 01C

An investigation has been conducted at Mach numbers of 0.60 and 0.90 to determine the effects of various combinations of leading-edge Krueger flaps, inboard plain flaps, and out-board slats on the static aerodynamic characteristics of a twin-jet, swept-wing fighter-airplane model. The angle-of-attack range was varied from -2 deg to 24 deg and the angle-of-sideslip range was varied from about 4 deg to -15 deg. The results of the investigation indicated that the addition of Krueger flaps caused significant improvements in maximum lift coefficient and in drag coefficient at high lift coefficients. Author

N71-38427# Sandia Labs., Albuquerque, N.Mex.
ANALOG SIMULATION OF A GUIDED PARACHUTE-PAYLOAD SYSTEM
R. Vaughn, G. E. Reis, and J. A. Stark May 1971 38 p refs
(SC-DR-710067) Avail: NTIS

A description is given of a device to complement field trials in training pilots in the maneuvering of a remotely controlled steerable parachute-payload system and to study the behavior of such a system when under the control of a pilot. The device consists of roll and glide controls operated by the pilot which are coupled to an analog computer that synthesizes the flight behavior of the parachute-payload system. A stylized picture of a ground target as seen by a camera on board the payload and generated in the computer is presented on an oscilloscope. This picture is viewed by the pilot who manipulates the controls and attempts to impact the parachute and payload on the target. Author

N71-38428# Massachusetts Inst. of Tech., Cambridge.
DEFINITION OF SAFE SEPARATION CRITERIA FOR EXTERNAL STORES AND PILOT ESCAPE CAPSULES Final Report, 20 Dec. 1968 - 28 Feb. 1970
Eugene E. Covert Jun. 1971 72 p refs
(Contract N000123-69-C-0821)
(AD-726695; NWC-TP-4995) Avail: NTIS CSCL 01/2

It is shown that the early part of the trajectory of any store or escape capsule released from a parent aircraft is governed principally by two effects. The first is the relative velocity between the store and the aircraft at the instant of release. The second is the acceleration acting on the store at the same instant. This acceleration is due not only to gravity, but also to the aerodynamic forces and moments acting on the store. The normalized relative velocity and normalized acceleration, as the ordinate and abcissa, define a planar coordinate system. A boundary delineating safe from unsafe separation characteristics can be drawn on this plane. Thus, if the proper data are available, safe separation conditions can be predicted in advance. The available data from flight tests strongly support the predictive aspects of this diagram. In principle, since the diagram is based on velocity and airloads, no additional information is needed to define safe-separation characteristics. Moreover, the results from this study suggest that airload data for the store on a rack can be directly applied to give valuable results about safe-store separation. Author (GRA)

N71-38429# Army Foreign Science and Technology Center, Charlottesville, Va.
HELICOPTER AERODYNAMICS
D. I. Bezov 14 May 1971 224 p refs Transl. into ENGLISH of the mono. "Aerodinamika Vertoleov" Moscow, Transport Publ. House, 1968 p 1-196
(AD-726841; FSTC-HT-23-548-71; ACSI-J-9360) Avail: NTIS CSCL 01/1

The book contains the principles of helicopter flight, special characteristics of the main rotor and its function in autorotation axial and oblique flow, regimes of vertical and horizontal flight, climb and descent, takeoff and landing, balance, stability and control of the helicopter and their acting aerodynamic forces. Author (GRA)

N71-38430# Naval Air Development Center, Johnsville, Pa. Aero Mechanics Dept.
DEVELOPMENT AND EVALUATION OF AIRCRAFT CLOCKS INSENSITIVE TO HIGH INTENSITY MAGNETIC FIELDS Final Report
Lloyd G. Blades 8 Jul. 1971 15 p
(AD-726700; NADC-AM-7123) Avail: NTIS CSCL 01/3

Aircraft mechanical clocks and battery-operated clocks designed to be resistant to high intensity magnetic fields were developed. Author (GRA)

N71-38431*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EVALUATION OF BREAKING PERFORMANCE OF A LIGHT, TWIN-ENGINE AIRPLANE ON GROOVED AND UNGROOVED PAVEMENTS
Thomas J. Yager, W. Pelham Phillips, and Perry L. Deal Washington Oct. 1971 35 p refs
(NASA-TN-D-6444; L-7643) Avail: NTIS CSCL 01A

The braking performance of a nine-place, light, twin-engine airplane was evaluated on comparative grooved and ungrooved surfaces of a landing research runway. The test airplane was equipped with manual braking on the main wheels of the tricycle landing gear, and its weight varied from (7500 to 9000 lb). The test results indicate that pavement grooving significantly improves aircraft braking and directional control on wet runways. Measurements and observations of airplane tire treads made during this test program showed no indication of unusual wear and/or damage attributable to grooved surfaces. Comparative braking data obtained with a jet fighter and a civil and a military jet transport are also presented. Author

N71-38432# Nortronics, Palos Verdes Peninsula, Calif. Electronics Div.
CONCEPT FORMULATION STUDY FOR AUTOMATIC INSPECTION, DIAGNOSTIC AND PROGNOSTIC SYSTEMS (AIDAPS) Interim Report
Apr. 1971 349 p refs
(Contract DAAJ01-71-C-0503)
(AD-726951; NORT-71-209-1; USAAVSCOM-TR-72-1; IR-1) Avail: NTIS CSCL 01/3

The report represents the first formally documented submittal prepared as part of the concept formulation study for Automatic Inspection, Diagnostic and Prognostic Systems (AIDAPS) for Army aircraft. The principal objective of this phase A effort is to establish that only basic engineering, rather than experimental effort, is required to proceed with engineering development of AIDAP systems. Confirmation of this fact is presented by in-depth discussions of the availability of applicable AIDAPS technology thereby demonstrating categorically the feasibility of proceeding with development and deployment of AIDAP systems without further research effort. In the process of accomplishing this objective, several subsidiary tasks were performed that provide a base of information from which phases B and C can proceed. Author (GRA)

N71-38433# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
AIRCRAFT ACCIDENT REPORTS: BRIEF FORMAT, SUPPLEMENTAL ISSUE, 1969 ACCIDENTS
Jul. 1971 83 p
(NTSB-BA-71-2) Avail: NTIS

Reports of 108 aircraft accidents are presented as a supplement for 1969. The accident reports included were delayed pending supplemental data, additional study, or because of difficult areas in the investigation. Twenty-seven of the reports cover foreign registered aircraft accidents that occurred in the United States or its possessions. Author

N71-38434# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT PRELIMINARY REPORT: ALASKA AIRLINES, INCORPORATED, BOEING 727, N2969G, JUNEAU, ALASKA, 4 SEPTEMBER 1971
12 Oct. 1971 10 p
(SB-71-87) Avail: NTIS

The facts, circumstances, and conditions surrounding the fatal crash of the Alaska Airline, Inc., Flight 1866 on September 4, 1971 are presented. No concrete causes were established for the accident. E.H.W.

N71-38435*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
STABILITY AND CONTROL CHARACTERISTICS OF A LARGE SCALE DEFLECTED SLIPSTEAM STOL MODEL WITH A WING OF 5.7 ASPECT RATIO
V. Robert Page and Thomas N. Aiken Washington Oct. 1971 68 p refs
(NASA-TN-D-6393; A-3342) Avail: NTIS CSCL 01B

A wind tunnel investigation was conducted to determine the stability and control characteristics of a large scale model representative of a propeller-driven STOL transport. Longitudinal and lateral directional characteristics were obtained for a four-engine configuration having a wing of 5.7 aspect ratio fully immersed in the propeller slipstream. Configuration variables included an aileron, a spoiler, a slot-lip aileron, a spanwise variation of propeller thrust, and two vertical heights of the horizontal tail. Author

N71-38436*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LARGE-SCALE WIND-TUNNEL TESTS OF A PROPELLER-DRIVEN DEFLECTED SLIPSTREAM STOL MODEL IN GROUND EFFECT
V. Robert Page and Thomas N. Aiken Washington Oct. 1971 42 p refs
(NASA-TM-X-2313; A-3927) Avail: NTIS CSCL 01A

A wind-tunnel investigation was conducted to determine the longitudinal and lateral-directional characteristics of a large-scale STOL transport model in ground effect. Test configurations included three wing spans (aspect ratios, 5.71, 6.52, and 8.06), with and without full-span triple-slotted trailing-edge flaps, horizontal tail on and off, spanwise variation of propeller thrust (to vary the span loading and descent capability), differential propeller pitch for yaw control, and spoiler and slot-lip aileron for roll control. Author

N71-38437# National Transportation Safety Board, Washington, D.C.
ANNUAL REVIEW OF AIRCRAFT ACCIDENT DATA: US AIR CARRIER OPERATIONS, CALENDAR YEAR 1969
18 Aug. 1971 119 p
(NTSB-ARC-71-1) Avail: NTIS

Statistical, cause/factor and injury tables, accident rates, and the briefs of accidents involving U.S. air carriers are reported for 1969. An analysis of the operation and safety record of these carriers by type of power and class of carrier is included. Author

N71-38438# Federal Aviation Administration, Washington, D.C. Flight Standards Service.
MULTIENGINE AIRPLANE CLASS OR TYPE RATING
1971 29 p Revised
(FAA-AC-61-4C) Avail: NTIS; SOD $0.25

A guide was developed to assist applicants for multiengine rating in preparing for his certification or rating flight test. The guide provides explanations of the procedures, maneuvers, and the acceptable performance necessary to pass such a test according to Federal Aviation Regulations. The test is given in three phases: (1) oral operational test, (2) basic piloting techniques, and (3) multiengine emergency procedures. The failure of any required item constitutes the failure of the phase involved and of the flight test. E.H.W.

N71-38439# Naval Air Development Center, Johnsville, Pa. Aero Mechanics Dept.
MATHEMATICAL MODELING OF F8-E WAVE-OFF TRAJECTORIES FOR TSP (TERMINAL STATE PREDICTOR) Phase Report
David B. Bailey 1 Jul. 1971 26 p ref
(AD-727121; NADC-AM-7119) Avail: NTIS CSCL 01/2

F-8E wave-off trajectories are mathematically modeled for the terminal state predictor systems. A carrier-approach critical state identifier, using nonlinear range and altitude equations, is discussed. GRA

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N71-38440*# Pennsylvania Univ., Philadelphia. Inst. for Direct Energy Conversion.
RESEARCH FOR THE IMPROVEMENT OF SILICON SOLAR CELL EFFICIENCY Status Report, 1 Jan. - 30 Jun. 1971
M. Wolf Jul. 1971 81 p refs
(Grant NGL-39-010-001)
(NASA-CR-122921; SR-18) Avail: NTIS CSCL 10A

Solar cell design curves for collection efficiency from the diffused and base region are presented along with the results of the investigations of the current-voltage characteristics. The program VICHAR which is considered to be an excellent tool for evaluating experimental data of current-voltage characteristics of silicon solar cells is also included. F.O.S.

N71-38441*# TRW Systems Group, Redondo Beach, Calif.
STUDY TO ESTABLISH CRITERIA FOR A SOLAR CELL ARRAY FOR USE AS A PRIMARY POWER SOURCE FOR A LUNAR-BASED WATER ELECTROLYSIS SYSTEM, PHASE 4 Final Technical Report, 15 Dec. 1970 - 15 Sep. 1971
J. E. Boretz and P. Goldsmith 15 Sep. 1971 54 p refs
(Contract NAS8-21189)
(NASA-CR-119845; TRW-09681-6008-R000) Avail: NTIS CSCL 10A

The prototype solar array panel was subjected to structural-dynamic, acoustic, and thermal vacuum cycling tests. In addition, electrical performance tests were conducted at the beginning and upon completion of the qualification test program. The design configuration is now considered technology-ready for future lunar surface applications. It has comparatively high specific power and is recommended for use in earth-orbital and planetary exploration programs where deployable, rigid panel solar arrays are required. E.M.C.

N71-38442*# TRW Systems Group, Redondo Beach, Calif.
STUDY AND DETERMINATION OF AN OPTIMUM DESIGN FOR SPACE UTILIZED LITHIUM-DOPED SOLAR CELLS, PART 2 Final Report
R. G. Downing and J. R. Carter, Jr. 15 Jul. 1971 129 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952554)
(NASA-CR-122942; TRW-13154-6022-R0-00) Avail: NTIS CSCL 10A

Several groups of lithium-doped solar cells were evaluated for hardness to 1 MeV electron irradiation. The groups represent programmed variations in manufacturing technique. The cells exhibiting highest recovered powers were fabricated with relatively low lithium donor concentration at the junction within a range of 2 to 4 x 10 to the 14th power Li./cu cm. The lower lithium donor concentrations have produced cells of equal or superior efficiency to conventional n/p cells. Lithium diffusions of 8 hours at 325 C have produced excellent cells. Other factors such as boron diffusion source and lithium source area variation do not appear to significantly effect radiation hardness. Solar simulator measurements were made on many cells representing cell groups showing the highest recovered outputs. These results confirm that lithium-doped solar cells, fabricated to an optimum design, are superior in hardness to conventional n/p solar cells. Changes in the lithium donor concentration during the recovery of irradiated cells were monitored by capacitance-voltage measurements. A physical model of the recovery process is proposed in which the defects formed during irradiation act as nuclei for the precipitation of lithium donors. Author (NSA)

N71-38443*# Lockheed-Georgia Co., Marietta.
THE EFFECT OF RADIATION ON LITHIUM DOPED SOLAR CELLS Final Report
M. C. Whiffen 20 Jul. 1971 116 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952588)
(NASA-CR-122843; ER-11150) Avail: NTIS CSCL 10A

A description is given of the irradiation of lithium doped p/n solar cells at temperatures of 223, 303, and 253 K. Irradiation was conducted in vacuum and the source was Sr 90 beta particles at a rate of 10 to the 12th power e/sq cm/day. The cells were irradiated to a fluence of 2 x 10 to the 14th power e/sq cm. Conventional n/p cells were included for comparison. Results of the test show that crucible grown lithium cells are superior at 353 K while float zone grown lithium diffused cells are slightly superior at 303, and at 223 K, where lithium mobility is very low, conventional n/p cells are superior. Author

N71-38444*# Massachusetts Inst. of Tech., Cambridge. Center for Materials Science and Engineering.
RADIATION DAMAGE ANNEALING KINETICS IN LITHIUM-DIFFUSED SILICON SOLAR CELLS Annual Report
M. S. Dresselhaus Jul. 1971 26 p refs
(Contracts NAS7-100; JPL-952938)
(NASA-CR-122867) Avail: NTIS CSCL 10A

A model for the annealing kinetics of radiation damage in lithium-diffused silicon solar cells has been developed using a phenomenological approach, whereby the carrier recombination rate is found through use of the Shockley-Read-Hall theory for carrier lifetime. The annealing process is handled through a time-dependent recombination center density according to the kinetic equations of Fang. Even though it appears to be an oversimplification to use a single level form of the Shockley-Read-Hall theory and first order kinetics in the Fang theory, these forms are used as a first approximation. With these simplifications, it is feasible to develop a computer program to predict device performance from specified cell characteristics in lithium-diffused silicon solar cells. Author

N71-38445*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOLAR CELL PERFORMANCE AS A FUNCTION OF TEMPERATURE AND ILLUMINATION ANGLE OF INCIDENCE
B. E. Anspaugh 15 Sep. 1971 28 p refs
(Contract NAS7-100)
(NASA-CR-122831; JPL-TM-33-485) Avail: NTIS CSCL 10A

The response of solar cells to nonnormal illumination was measured. A heliostat in the JPL Celestarium was available for performing preflight calibrations on the experimental solar panels to be flown on Applications Technology Satellite E (ATS-E). The heliostat produced an accurately parallel vertical beam inside a dark room with nonreflecting walls and ceiling. This source proved to be ideal for the required calibration runs. The results of this testing and a comparison with a simple theory are presented. Author

N71-38446*# Bendix Corp., Kansas City, Mo.
HIGH TEMPERATURE THERMAL INSULATION Quarterly Report
Gary L. Kalso May 1971 67 p
(Contract AT(29-1)-613)
(BDX-613-313; QR-FY-71-1) Avail: NTIS

The manufacture of high temperature, low density, thermal insulation parts has been under investigation. Fiberfrax paper was tested for this purpose because it has low density and a low coefficient of thermal conductivity up to 2300 F. Fiberfrax consists of short fibers of alumina-silicate compressed into a mat. It has little tear strength and requires careful impregnation with a rigidizer solution which increases the strength of the paper. The fundamental process is not new, but control of properties such as density uniformity and material determinations

was necessary to produce the high quality thermal insulation required. The basic investigations resulted in establishing the capability of fabricating Fiberfrax parts with hemispherical and cylindrical shapes. Machinability, density, delamination, and compressive strength were studied and controlled. Author (NSA)

N71-36447# Battelle Memorial Inst., Columbus, Ohio.
LITHIUM BATTERY DEVELOPMENT. Annual Report, 1 Apr. 1970 - 31 Mar. 1971
D. E. Semones and J. McCallum Jun. 1971 80 p refs
(Contract F33615-68-C-1282)
(AD-726807; AFAPL-TR-71-49; AR-3) Avail: NTIS CSCL 10/3

The report describes research on inorganic compounds for use as positive electrodes in a rechargeable lithium battery. First, desired characteristics of the candidate electrode materials were considered, including theoretical voltages and idealized weight relationships and, therefore, the maximum watt hours per pound that could be expected. Two dozen separate compounds were considered in this preliminary analysis from among seven general classes of inorganic compounds that included the metal salts of carbonates, cyanides, cyanates, thiocyanates, hydroxides, sulfides, and methoxides. Second, electrolytes to be used in combination with the candidate electrode compound were developed. One prerequisite for rechargeability in the electrolyte development was the presence of an anion common to both the positive electrode compound and to the electrolyte solute. An electrolyte resistivity lower than 1000 ohm-cm also was sought in these studies as well as stability of the electrolyte with the positive electrode compound and with lithium. Author (GRA)

N71-36448# Joint Publications Research Service, Washington, D.C.
DISCHARGE OF A SUPERCONDUCTING ACCUMULATOR INTO AN INVERTED CONVERTER
V. V. Andrianov et al 14 Sep. 1971 6 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 198, no. 2, 1971 p 320-323
(JPRS-54051) Avail: NTIS

The use of superconducting inductive energy accumulators as standby electrical energy sources, as energy sources for load factoring in power systems, and as sources for powerful electrical pulses is discussed. An inverted converter is proposed as a means of transfering the superconducting accumulator's energy into an electrical system. J.G.M.

N71-36449# Army Electronics Command, Fort Monmouth, N.J.
ENGINEERING EVALUATION OF STANDARD LINE RESERVE LOW TEMPERATURE BATTERIES
Achille L. Almerini May 1971 36 p refs
(AD-726948; ECOM-3427) Avail: NTIS CSCL 10/3

Batteries BA-838( )/U (four pounds) and BA-839( )/U (six pounds) had been designed, fabricated and fully qualified to meet the requirements of one specialized application, the AN/PRC-70 transceiver. This report describes an internal engineering evaluation on these batteries, to further probe the operational characteristics under a wide range of conditions, to determine operational limitations and to establish areas where there is need for further research and development to improve low temperature performance. The present battery designs are most efficient at -40F to power intermittent equipment where the power demands are moderate to high (e.g. AN/PRC-70 and the Army Controlled Air Drop Cargo System (CADCS)). Efficiency is much reduced with the present designs when low power demands exist, such as for the AN/PRC-25 transceiver. Author (GRA)

N71-36450*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMBINED TURBINE-MAGNETOHYDRODYNAMIC BRAYTON CYCLE POWER SYSTEM FOR SPACE AND GROUND USE
Lester D. Nichols Washington Oct. 1971 48 p refs
(NASA-TN-D-6513; E-6442) Avail: NTIS CSCL 10A

A combined turbine-MHD generator operating in a Brayton cycle with a NERVA nuclear reactor is considered, both for use in space and on the ground. The combined system is compared with an all-MHD Brayton system and an all-turbine system. The combined cycle systems have higher thermodynamic efficiencies than the other systems. The combined system with 1500 K turbine inlet and the all-MHD system with generator efficiency of 0.8 have the lowest specific recuperator plus radiator mass of those systems considered. But the combined system considered has an average radiator temperature of 200 to 250 K lower than the other. For ground use, a cycle efficiency of greater than 0.55 can be achieved. Author

N71-36451*# General Electric Co., Pleasanton, Calif.
PERFORMANCE OF CYLINDRICAL CONVERTERS WITH PREFERRED-CRYSTAL-ORIENTATION EMITTERS OF CHEMICALLY VAPOR DEPOSITED TUNGSTEN
G. I. Samstad, J. C. Danko, and J. M. Case Washington NASA Sep. 1971 151 p refs
(Contract NAS3-6511)
(NASA-CR-1898; GESP-9018) Avail: NTIS CSCL 20L

A cylindrical out-of-pile thermionic converter test vehicle was designed to determine the performance of tungsten emitters with a preferred crystal orientation. The design included provisions for the direct measurement of emitter temperature; three high temperature thermocouples and a black-body hole. Also included was the design provision for changing the electron bombardment heater without altering the converter proper. Each emitter was carefully characterized by chemistry, microstructural analyses, vacuum work function, and X-ray diffraction analyses. Three converters were fabricated and tested. The emitters of these converters included two of chloride vapor-deposited tungsten with a preferred (110) crystal orientation and one with a fluoride vapor-deposited tungsten of nominal (100) crystal orientation which was deep electroetched to expose the (110) crystal facets. A niobium collector and a 0.010-inch interelectrode spacing was used on all converters. The test program included periodic thermionic performance mapping and steady-state operation for 5000 hours at an emitter temperature of 1700 C. The test results of these converters showed that there is comparable thermionic performance after 5000 hours of operation even though their emitters were produced by two distinctly different methods. The operating results together with the post-test examination of all three converters are presented and discussed. Author

N71-36452*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
POWER AND LOAD PRIORITY CONTROL CONCEPT FOR A BRAYTON CYCLE POWER SYSTEM
Eugene L. Kelsey and Richard N. Young Washington Oct. 1971 27 p refs
(NASA-TN-D-6478; L-7865) Avail: NTIS CSCL 10B

A load-oriented control system is conceived and applied to a Brayton cycle turbo-alternator. The concept provides speed control and field current control for the alternator and a load simulation which includes energy storage. A laboratory model was constructed and tested with the Brayton cycle demonstrator at the Manned Spacecraft Center. Author

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N71-36453*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
PROCEEDINGS OF THE 1970 MANNED SPACECRAFT

CENTER ENDOCRINE PROGRAM CONFERENCE
Aug. 1971 148 p refs Conf. held at Houston, Tex., 5-7 Oct. 1970
(NASA-TM-X-58068) Avail: NTIS CSCL 06P

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8. HORMONAL CONTROL OF CALCIUM METABOLISM J. T. Potts, Jr. (Mass. Gen. Hosp., Boston) 21 p refs (See N71-36461 23-04)

9. PEPTIDE HORMONES IN URINE D. H. Nelson and J. E. Bethune (Univ. of Southern Calif., Los Angeles) 10 p (See N71-36462 23-04)

10. PRELIMINARY RESULTS OF ACTH RADIOIMMUNOASSY B. O. Campbell (Baylor Univ., Houston, Tex.) 11 p refs (See N71-36463 23-04)

N71-36454*# Baylor Univ., Houston, Tex. Nuclear Medicine Section.
RED-CELL-MASS AND PLASMA-VOLUME CHANGES OBSERVED IN ASTRONAUTS ON THREE GEMINI AND THREE APOLLO MISSIONS
Philip C. Johnson *In* NASA Manned Spacecraft Center Proc. of the 1970 Manned Spacecraft Center Endocrine Program Conf. Aug. 1971 11 p refs (See N71-36453 23-04)
Avail: NTIS CSCL 06P

Nuclear-medicine procedures were performed for three Gemini and three Apollo missions. Because these studies are the only nuclear-medicine procedures ever performed for crews who have been in a weightless environment, it is not possible to compare these results with any others. The nuclear-medicine studies were assigned to these missions as one part of the medical operational support required to guarantee the safety of the crews. Because these were operational studies rather than research studies, the number of data points was limited to the minimum number that was absolutely necessary to guarantee crew safety. The missions studies have included both the high oxygen/zero nitrogen atmosphere of the Gemini Program and the somewhat lower oxygen/partial nitrogen atmosphere of the non-lunar landing Apollo missions. Specimens have been obtained at the Manned Spacecraft Center, at the Kennedy Space Center, and aboard the recovery carriers. The Apollo data included ground-based controls. Author

N71-36455*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
HEMATOLOGY RESULTS ON GEMINI AND APOLLO MISSIONS
Craig L. Fischer and Stephen L. Kimzey *In its* Proc. of the 1970 Manned Spacecraft Center Endocrine Program Conf. Aug. 1971 14 p refs (See N71-36453 23-04)
Avail: NTIS CSCL 06P

Summaries are presented of what was known about red cell mass and plasma volume based on the Gemini Program. The hematological and biochemical programs for Apollo are described. Hematological evaluation of Apollo flights has shown the very strong, protective, and active effects of the nitrogen in the spacecraft cabin environment. The biochemical program data indicate: (1) A postflight hyperglycemia is regularly observed as the result of an increased release of catecholeminoes that are secondary to the stress of entry. (2) Serum-cholesterol and uric acid levels generally decline during the flights. (3) A transient postflight decrease in LDH 3 (associated with an increase in LDH 4) is often observed. (4) A transient postflight decrease in total serum carbon dioxide has been observed in the one crew (Apollo 13) tested for this parameter. A.L.

N71-36456*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
REVIEW OF ENDOCRINE RESULTS: PROJECT MERCURY, GEMINI PROGRAM, AND APOLLO PROGRAM
Carolyn S. Leach *In its* Proc. of the 1970 Manned Spacecraft Center Endocrine Program Conf. Aug. 1971 16 p refs (See N71-36453 23-04)
Avail: NTIS CSCL 06P

Results of endocrine control of body fluids and electrolytes during Mercury, Gemini, and Apollo missions are reviewed. It is pointed out that the effect of endocrine control associated with space flight is just now being considered in depth. Although it is not believed that the changes observed constitute any immediate danger to the crewmen, it is thought that this adaptation to a weightless state costs energy and uses reserves, a situation that places homeostatic mechanisms at the edge of safety margin; furthermore, a severe stress beyond this weightless state would prove a difficult challenge for these control mechanisms. The second area of endocrine investigation (the qualification of stress) has been equally productive. The measurement of adrenal hormone activity has provided assessment of each crewmen's response to the space flight environment. However, more data are needed for a prediction of postflight response on the basis of preflight values; and, only when samples are taken during the flight, will this correlation be complete. These examinations will not be possible until the earth orbital Skylab missions scheduled for 1973. Author

N71-36457*# Baylor Univ., Houston, Tex. Coll. of Medicine.
REVIEW OF METABOLIC AND ENDOCRINE STUDIES ON THE GEMINI 7 MISSION
Harry S. Lipscomb *In* NASA. Manned Spacecraft Center Proc. of the 1970 Manned Spacecraft Center Endocrine Program Conf. Aug. 1971 4 p ref (See N71-36453 23-04)
Avail: NTIS CSCL 06P

This study was planned within the rigorous constraints of the technical characteristics of the mission itself. For this reason, it was a formidable research task to ensure that adequate collection of samples was obtained and that adequate preflight and postflight followup studies were conducted properly. The primary goal of these studies was to measure changes, if any, that may have been produced by the period of zero gravity in space on total body metabolism related both to the musculoskeletal and endocrine systems. Within the broad limits of precision of this first metabolic study in space, changes in mineral and hormonal balance were sufficiently modest to support, from the metabolic point of view, the decisions that a voyage to and return from the moon would be medically safe. It is believed that more careful scrutiny must be given to the insistence on exercise on a regular basis as an integral part of the space flight to prevent predicted calcium losses in urine and the subsequent destruction of bone. Equally important, changes in red blood cell mass and changes in blood pressure maintenance and regulation will require scrupulous attention. Author

N71-38488*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
JOINT AMES RESEARCH CENTER/MANNED SPACECRAFT CENTER STUDY: DIURNAL VARIATION IN ADRENOCORTICAL AND THYROID FUNCTION DURING PROLONGED BEDREST
Joan Vernikos-Danellis *In its* Proc. of the 1970 Manned Spacecraft Center Endocrine Program Conf. Aug. 1971 14 p refs (See N71-38453 23-04)
Avail: NTIS CSCL 06P

In an effort to collect preliminary information about changes in the endocrine system of man during prolonged exposure to hypokinesic conditions and to postural changes and confinement, cortisol, thyroxine, and tri-iodothyronine blood levels were determined during a 56-day bedrest study. The data indicate that altering the hydrostatic pressure for long periods of time causes a reduction in the circulating hydrocortisone rhythm amplitude, increases in thyroid hormone levels, and a desynchronization of thyroid rhythms with light as well as steroids. The dissociation of the thyroid rhythms from both the hydrocortisone rhythm and the light-and-activity schedule, and the prompt reassociation of the two rhythms in the postbedrest ambulatory period suggest that the thyroid rhythm may be posture dependent. The fact that a vigorous exercise program did not prevent or correct the heart rate, temperature, and endocrine changes induced by 56 days of absolute bedrest, indicates that corrective measures other than exercise should be sought. A.L.

N71-38489*# New York State Univ., Syracuse. Upstate Medical Center.
RADIOIMMUNOASSAY OF ANTIDIURETIC HORMONE
Myron Miller *In* NASA. Manned Spacecraft Center Endocrine Program Conf. Aug. 1971 18 p refs (See N71-38453 23-04)
Avail: NTIS CSCL 06P

Work conducted on the development of a radioimmunoassay system for urinary antidiuretic hormone (ADH) and its application in the study of man in space is presented. The data highlight some of the features of the assay and some of the evidence that demonstrates that changes in urinary ADH excretion occurs after physiological stimulation and that these changes can be measured. The assay system uses an antibody that was developed by immunizing rabbits with lysine vasopressin, which is one amino acid different from arginine vasopressin, the natural ADH of man. The methodology for determination of urinary ADH was evidently verified by the studies performed. Urine can be concentrated to raise the level of ADH in the specimen to the level of sensitivity of the assay. By using this technique, it is possible to measure quantitatively changes in urinary ADH excretion that would be expected to occur in response to the physiological stimuli and thus make possible study of the role of ADH in water regulation. A.L.

N71-38490*# Harvard Univ., Boston, Mass. Medical School.
HUMAN VASOREGULATION BY RENIN, ANGIOTENSIN, AND ALDOSTERONE
Edgar Haber *In* NASA. Manned Spacecraft Center Proc. of the 1970 Manned Spacecraft Center Endocrine Program Conf. Aug. 1971 18 p refs Prepared in cooperation with Mass. Gen. Hospital (See N71-38453 23-04)
Avail: NTIS CSCL 06P

Human physiological studies, using the radioimmunoassays for angiotensin 1 and 2 are discussed along with the development of a radioimmunoassay technique for aldosterone. It is anticipated that future studies combining these methods in human investigation will yield insights into vasomotor regulation. A.L.

N71-38491*# Massachusetts General Hospital, Boston. Endocrine Unit.
HORMONAL CONTROL OF CALCIUM METABOLISM
John T. Potts, Jr. *In* NASA. Manned Spacecraft Center Proc. of the 1970 Manned Spacecraft Center Endocrine Program Conf. Aug. 1971 21 p refs (See N71-38453 23-04)
Avail: NTIS CSCL 06P

Three analytical techniques are of particular interest in the study of calcium and bone metabolism; these techniques are the assays for parathyroid hormone, calcitonin, and vitamin D. Discussion is limited to the current methods of assay and the uses to which the assays might be put. Author

N71-38492*# University of Southern Calif., Los Angeles. School of Medicine
PEPTIDE HORMONES IN URINE
Don H. Nelson and John E. Bethune *In* NASA. Manned Spacecraft Center Proc. of the 1970 Manned Spacecraft Center Endocrine Program Conf. Aug. 1971 10 p (See N71-38453 23-04)
Avail: NTIS CSCL 06P

The program of studying peptide hormones in urine was initiated as part of an overall investigation of the effects of space flight on bone metabolism as related to a pituitary-adrenal stress and parathyroid hormone (PTH) secretion. Because it was evident that only urine samples would be available (for some time in the future), it was proposed to develop suitable methods for assaying PTH and adrenocorticotropic hormone (ACTH) in urine as measures of stress and parathyroid function. Progress in assaying these two peptides is summarized. Author

N71-38493*# Baylor Univ., Houston, Tex. Dept. of Biochemistry.
PRELIMINARY RESULTS OF ACTH RADIOIMMUNOASSAY
Bonnelle O. Campbell *In* NASA. Manned Spacecraft Center Proc. of the 1970 Manned Spacecraft Center Endocrine Program Conf. Aug. 1971 11 p refs (See N71-38453 23-04)
Avail: NTIS CSCL 06E

The use of radioimmunochemical assay for ACTH in this research program is to establish the capability for routine analysis of human plasma levels of corticotrophin while performing three groundbased studies: (1) Circulating plasma levels of ACTH to be measured directly to establish base-line values of normal ACTH secretion obtained under various nonstress situations. (2) Normal ACTH values obtained under restful conditions to be analyzed in real time for circadian variation and correlated with available cortisol values that would indicate an underlying circadian rhythm in the total pituitary-adrenal axis. (3) The limits of the radioimmunochemical assay in determining the stressed state as opposed to base-line or nonstress values are considered, as well as the effect of stress situation on the circulating plasma levels. Author

N71-38494*+ California Univ., Los Angeles. Dept. of Psychology.
BRAIN MECHANISMS OF AROUSAL, ATTENTION AND PERCEPTION Terminal Report, 1 Jul. 1968 - 30 Jun. 1971
Donald B. Lindsley Jun. 1971 5 p refs
(Grant NGL-06-007-049)
(NASA-CR-122941) Avail: NTIS CSCL 06P

The results are briefly described of continuing research on the neural mechanisms underlying visual perception, arousal, attention, vigilance, and decision processes in man, cat, and monkey. Most of the studies involved the use of cats and monkeys, as it was necessary to deal with subcortical structures by means of recording and stimulating electrodes maneuvered by stereotaxic techniques directly to the deeper regions of the brain. Research on man consisted of a study of the three major electrical phenomena of the brain that could be recorded from the outside of the skull by means of electrodes on the scalp. These include: (1) the spontaneous electroencephalogram with its alpha waves and other activity; (2) the average evoked potentials which normally cannot be seen in the EEG proper; and (3) the contingent negative variation, or slow potential shift associated with anticipation or expectancy. D.L.G.

N71-36468*# California Univ., Los Angeles. Dept. of Chemistry.
PREPARATION OF TUMOR SPECIFIC BORON COMPOUNDS. 1: IN VITRO STUDIES USING BORON LABELED ANTIBODIES AND ELEMENTAL BORON AS NEUTRON TARGETS
M. Frederick Hawthorne, Richard J. Wiersema, and Mitsuo Takasugi [1971] 28 p refs /ts Contrib. No. 2878
(Grant NGL-05-007-003)
(NASA-CR-122925) Avail: NTIS CSCL 06E

The diazonium salt of 1-(4-aminophenyl)-1,2-dicarbaclosododo caborane(12) has been incorporated into anti-bovine serum albumin and antibody proteins specific to human and mouse histocompatibility antigens. The incorporation of the boron-label (natural isotopic abundance) into the antibody is sufficient to cause specific cellular destruction when subjected to neutron radiation in vitro. It has also been demonstrated that particulate boron (natural isotopic abundance) is incorporated into Walker 256 cells which can be specifically destroyed with neutron radiation. These results suggest that the concept of incorporating boron into proteins which exhibit marked tumor-specificity is of great potential for use in neutron-capture therapy. The potential use of boron-containing compounds in cancer therapy is based on the unique nuclear property of the boron-10 nucleus to absorb thermal neutrons. This approach to cancer therapy is based on the liberation of high-energy fission fragments following neutron capture. Author

N71-36469*# Scientific Translation Service, Santa Barbara, Calif.
ESSAY ON LIFE [ENSAYO A LA VIDA]
Felipe Leon Leyva Oct. 1971 31 p Transl. of Mexican book
(Contract NASw-2035)
(NASA-TT-F-13964) Avail: NTIS CSCL 06P

The efforts of medical science to study and control the aging process over the centuries are described. The results of research on human life are presented, and it is indicated that these results made it possible to invigorate the cells comprising the human body and to thus achieve perfect health. The processes on earth are described, followed by a description of the human body including its cells and the brain. It is postulated that the source of human health and energy lies in the electricity which the body receives from space. Electricity was supplied to the body in the form of a fluid reactivating combustion in the human system and strengthening the cells, thus improving bodily conditions. Author

N71-36487*# Minnesota Univ., Minneapolis. Div. of Environmental Health.
ENVIRONMENTAL MICROBIOLOGY AS RELATED TO PLANETARY QUARANTINE Semiannual Progress Report, Jun. 1970
Irving J. Pflug Jun. 1970 109 p refs
(Grant NGL-24-005-160)
(NASA-CR-122068; SAPR-4) Avail: NTIS CSCL 06M

The long term survival rates of Bacillus subtilis var. niger spores on glass and stainless steel surfaces, under temperatures less than 80 C and varying humidity conditions, are investigated. The effects of dry heat and chemical approaches in a closed system are also investigated. Attempts were made to measure box-to-box variations at several temperature-humidity conditions. Results indicate little change in box to box conditions; under temperature and humidity conditions, it was found that there is a significant change in survival rate with time. Experiments were carried out in distilled and buffered distilled water. Little difference was observed in the survival rates between the two waters. E.H.W.

N71-36488*# National Communicable Disease Center, Atlanta, Ga. Epidemiology Program.
GERMICIDAL ACTIVITY OF ETHYLENE OXIDE
Oct. 1969 4 p refs
(NASA Order R-11-004-001)
(NASA-CR-122069; PR-14) Avail: NTIS CSCL 06M

Sampling efforts using millipore filters to collect naturally occurring airborne microflora are reported. Natural contamination from 7620 cu ft of air, on 114 filters, was exposed to ethylene oxide gas while a collection from 1980 cu ft of air, on 30 filters, served as control samples. The control filters and the gas-exposed filters were incubated both aerobically and anaerobically. The surface colonial growth was counted and recorded with the aid of a binocular dissecting microscope. Viable particle counts on the control filters ranged from 10 to 122 per filter with a mean of approximately 60 as determined by aerobic methods of cultivation. Anaerobic cultivation produced counts ranging from 0 to 8 viable particles per filter with a mean of approximately 2 per filter. Filters exposed to ethylene oxide and incubated for 14 days did not demonstrate a survival of microorganisms. Another study involving the exposure of anaerobic spores to gaseous ethylene oxide is also reported. D.L.G.

N71-36489*# Scientific Translation Service, Santa Barbara, Calif.
HEAT: BIOLOGICAL EFFECTS, OCCUPATIONAL HYGIENE SIGNIFICANCE AND POSSIBILITIES OF PROTECTION. DRINKING DURING HIGH TEMPERATURE WORK [HITZE: BIOLOGISCHE WIRKUNGEN, ARBEITSHYGIENISCHE BEDEUTUNG UND SCHUTZMOEGLICHKEITEN]
Karl Heinz Richter Washington NASA Oct. 1971 10 p Transl. into ENGLISH from Staatsverlag der Deutschen Demokratischen Rep. (Berlin) 1968 p 177-184
(Contract NASw-2035)
(NASA-TT-F-14002) Avail: NTIS CSCL 06S

Advantages of various types of liquids offered to workers working under hot conditions (miners, fire fighters, steelworkers) are compared. Frequency and amount of liquid intake by each group are reported. A new liquid for this purpose (Contratherm) is described. Author

N71-36470*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FLOW DILUTION EFFECT ON BLOOD COAGULATION IN VIVO
Chia-lun Hu 15 Sep. 1971 27 p refs
(Contract NAS7-100)
(NASA-CR-122929; JPL-TM-33-480) Avail: NTIS CSCL 06S

A simple model of enzyme reactions and the flow dilution change of the reactions are discussed. First, the complex reactions in blood coagulation are discussed and weighed. Second, two controlling chemical reactions, the prothrombin-to-thrombin conversion and the inactivation of thrombin, both of which have significant positive and negative feedbacks, are selected. It is seen then, that the reaction rates of both these reactions will decrease as thrombin concentration is decreased by flow dilution. But the positive rate decreases more (because of the autocatalyzation of the prothrombin-thrombin conversion) than the negative rate. Therefore, when flow dilution increases, the overall reaction direction can be switched from the positive (procoagulative) direction to the negative (anticoagulative) direction; thus the in vivo coagulation is regulated and confined. This physical picture is analytically investigated by solving the modified Michaelis-Menton's enzyme rate equations. The effect of varying the antithrombin concentration is also investigated. The background and the physics of this analysis are extensively discussed. Author

N71-36471*# Staatliche Zentrale fuer Strahlenschutz, Berlin (East Germany).
RESULTS OF RADIATION PROTECTION MONITORING IN THE BIOSPHERE OF FALLOUT RADIOACTIVITY IN THE GERMAN DEMOCRATIC REPUBLIC, 1969 [ERGEBNISSE DER STRAHLENSCHUTZUEBERWACHUNG DER BIOSPHERE AUF FALLOUT-RADIOAKTIVITAET IN DER DEUTSCHEN DEMOKRATISCHEN REPUBLIK]

F. Moldenhawer and U. Schulze-Wollgast Jan. 1971 50 p refs In GERMAN; ENGLISH summary
(SZS-1/71) Avail: AEC Depository Libraries

In 1969 the results of fallout monitoring showed a further decrease of Sr-90 and Cs-137 contamination of nearly all environmental samples. On the average the concentration of Sr-90 decreased more heavily than that of Cs-137. The decrease of Sr-90 contamination of fallout, several plants (lucern, rye and wheat grain, potatoes) and milk was most marked. The Cs-137 contamination of several plants (turnip, lucern, potatoes) decreased too, whereas that of milk, total diet, grass and rye grain was unchanged in comparison with 1968. Author (NSA)

N71-36472*# Translation Consultants, Ltd., Arlington, Va.
TERRESTRIAL ORGANISMS SURVIVE IN SIMULATED JUPITER ATMOSPHERE [IRDISCHE ORGANISMEN UEBERLEBEN IN SIMULITERTER JUPITERATMOSPHAERE]
E. Koch Washington NASA Oct. 1971 9 p refs Transl. into ENGLISH from Sterne Weltraum (West Germany), v. 10, Mar. 1971 p 72-74
(Contract NASw-2038)
(NASA-TT-F-13944) Avail: NTIS CSCL 06M

It it pointed out that the present reducing atmosphere of the giant planets is very similar to the terrestrial atmosphere at the time of the origin of life on earth. Bacteria which use methane as a source for carbon are discussed, and the chemical reactions involved are examined. Investigations regarding an adaptation of various microorganisms to a methane-ammonia-hydrogen atmosphere are considered including tests in which plants such as the Euphorbia xylophyloides, Euphorbia hermentiana, and Euphorbia cladestina were kept for two months in such an atmosphere. It was found that many microorganisms at the plants had survived the imposed conditions and had even multiplied. Studies with a one-celled alga and with the aquatic plant Elodea are also discussed. Author

N71-36473*# Techtran Corp., Glen Burnie, Md.
DETERMINATION OF TRACE ELEMENTS IN SERUM AND URINE WITH FLAMELESS ATOMIZATION [BESTIMMUNG VON SPURENELEMENTEN IN SERUM UND URIN MIT FLAMMENLOSER ATOMISIERUNG]
B. Welz et al Washington NASA Oct. 1971 15 p refs Transl. into ENGLISH from Z. Anal. Chem. (East Germany), v. 252, 1970 p 111-117
(Contract NASw-2037)
(NASA-TT-F-13983) Avail: NTIS CSCL 06E

A graphite tube furnace for flameless atomic absorption spectroscopy (AAS) and its application in the analysis of biological materials is described. The values obtained for copper in twelve sera are in good agreement with colorimetric results and flame AAS. The sample volume needed for one determination is only 2 microliters of serum. Several other possible applications for the determination of trace elements and for working with minimum sample volumes are discussed.
Author

N71-36474# Cornell Univ., Ithaca, N.Y.
[PHOTOSYNTHETIC ENERGY CONVERSION] Annual Progress Report, 1 Sep. 1970 - 31 Aug. 1971
Roderick K. Clayton Aug. 1971 8 p refs
(Contract AT(30-1)-3759)
(NYO-3759-18) Avail: NTIS

Indications of electron transport in photosynthetic reaction centers in Rhodopseudomonas spheroides are reported. Factors cited include absorbancy changes, light and chemically induced bleaching of P870, electron acceptor pools, metal chelators, bacteriopheophytin, and the inhibition of photochemistry and fluorescence in reaction centers at pressures up to 6000 atm. Investigations with antibodies and with viruses which infect photosynthetic bacteria are also cited as well as experiments concerning photosynthetic membranes and energy conservation.
J.M.

N71-36475# Pennsylvania State Univ., University Park.
FIELD ION SHADOW PROJECTION MICROSCOPE AND OTHER FIM TECHNIQUES FOR VIEWING BIOMOLECULES Final Report
Erwin W. Mueller Apr. 1971 20 p refs
(Contract AT(30-1)-3851)
(NYO-3851-10) Avail: NTIS

The utilization of the atomic resolution capability of the field ion microscope for viewing biomolecules was investigated with various modifications of the conventional FIM techniques. The shadow projection method was found to yield insufficient resolution due to the inevitable penetration of the high field into the object space. A second method was the sandwiching of biomolecules between the tip surface and a pressed-on metal foil, with subsequent controlled field evaporation of the covering metal layer. The method proved useful for the study of adhesion of different metals, but no molecules were seen. A third method provided a strong bonding of biomolecules by pressing them into close contact with the tip surface. Various molecular spot patterns were observed and found to conform to expectations when specimens of known structure were used. Author

N71-36476# McDonnell-Douglas Astronautics Co., Newport Beach, Calif. Astropower Lab.
PATTERN RECOGNITION OF EEG TO DETERMINE LEVEL OF ALERTNESS Technical Progress Report, 16 Nov. 1969 - 14 May 1970
William B. Martin Jun. 1970 29 p
(Contract N00014-68-C-0277)
(AD-726473; DAC-60538-S4; TPR-4) Avail: NTIS CSCL 06/16

The report documents the work accomplished during the fourth reporting period in applying the principles of pattern recognition technology to the analysis of EEG. Several additional sleep scoring decision systems were investigated. Most classifications are performed satisfactorily. However, no reliable single channel frequency relationships have been discovered for separation of Stage 1 and REM. Also the transitional nature of Stage 3 patterns leads to confusing these patterns with Stage 2 or Stage 4. Cluster analysis was applied to frequency indicators derived from an overnight sleep record. Selection of clusters independent of human scoring demonstrated well defined groupings for awake, Stage 1 and REM combined, Stage 2 and Stage 4. Stage 3 patterns were split between the Stage 2 and Stage 4 clusters. Sleep scoring decision systems based upon frequency analysis of a single channel of EEG have been designed for each of two Tektite I aquanauts. Author (GRA)

N71-36477# Civil Aeromedical Inst., Oklahoma City, Okla.
ALCOHOL AND DISORIENTATION-RELATED RESPONSES. 2: NYSTAGMUS AND VERTIGO DURING ANGULAR ACCELERATION
David J. Schroeder Apr. 1971 27 p refs
(FAA-AM-71-16) Avail: NTIS

The effect of alcohol ingestion on both vertigo and nystagmus responses to angular stimulation is discussed. Responses were obtained with and without visual fixation, and with the alertness of the subjects controlled. When recorded in total darkness, the nystagmic response to rotatory stimulation was suppressed by the alcohol. When visual fixation was allowed, a high-frequency, low-amplitude nystagmus to rotation was obtained following alcohol ingestion; there was little or no response prior to drinking. This apparent enhancement of the response was not due to an increase in vestibular sensitivity but, rather, to the suppressive effect of alcohol on the ability of the subject to maintain adequate visual fixation. Vertigo sensations resulting from the rotatory stimuli evidenced only slight declines following alcohol ingestion. Author

N71-36478# Joint Publications Research Service, Washington, D.C.
RESEARCH EXPERIENCE IN THE COORDINATION OF GROUP CONTROL
A. I. Nazarov 14 Sep. 1971 66 p refs Transl. into ENGLISH

of the booklet "Opyt Issledovaniya Koordinatsii Gruppovogo Upravleniya" Moscow Univ. Publ. House, 1970 p 3-68
(JPRS-54046) Avail: NTIS

The coordinating mechanism for group control of a multiconnected system is studied by considering nerve formations in living organisms up to the neuron level. It is shown that the multiconnectivness of nerve formations is ruled by specialization and systematicity. Tests of perceiving images stabilized relative to the retina and modeling of psychological coordination mechanisms result in a principle of autonomy that controls the structure and parameters of multiconnected systems so that the controlled quantities do not influence each other. A homeostatic system is used to examine coordinated control mechanisms that include feedback functions of a human operator in a tracking process. G.G.

N71-36479# Joint Publications Research Service, Washington, D.C.
BIOGEOMETRY: USE OF GENERAL PURPOSE DIGITAL COMPUTERS FOR ANALYSIS OF BIOLOGICAL STRUCTURES
G. R. Ivanitskiy et al 13 Sep. 1971 37 p refs Transl. into ENGLISH of the publ. "Geometriya Zhivogo" Moscow, Znaniye Publishing House, 1971 p 1-32
(JPRS-54035) Avail: NTIS

Methods of investigating the geometry of living organisms using modern automation equipment and computer techniques are discussed. A system for automatic analysis of chromosomes is developed and illustrated with one typical example. Author

N71-36480# Joint Publications Research Service, Washington, D.C.
PROPHYLACTIC VITAMINIZATION WITH PYRIDOXINE CONTAINING COMPOUNDS AS A MEANS OF PREVENTING VESTIBULAR DISTURBANCES
E. V. Lapsyev et al 14 Sep. 1971 9 p refs Transl. into ENGLISH from Gigiena i Sanit. (Moscow), no. 5, 1971 p 30-34
(JPRS-54048) Avail: NTIS

The significance of prophylactic vitaminization with the purpose of preventing vestibular disturbances was studied in an intermediate climate zone (Moscow) and in a hot climate (Semarkand) in winter and summer. In both climate zones the diet of 98 healthy individuals, aged 19 to 45 was identical in content of the basic assimilated substances and vitamins. The amounts of N(1)-methylnicotinamide, riboflavin, thiamine, 4-pyridoxinic acid, and pyridoxine eliminated with the urine were used as indices to describe the state of the body's vitamin supply. The blood's pyridoxine content was determined microbiologically. The functional state of the vestibular analyzer was evaluated by means of the NKUK (continual coriolis acceleration accumulation) test and a rotating test using electromystagmography, and recording the duration of the illusion of counterrotation on the basis of subjective reports. For vitaminization, a complex including vitamin A, B1, B2, B6, PP, C, P, E, pantothenic acid, folic acid, and vitamin B12 was administered for eight days. Observations on 98 individuals are given. A reduction of vestibular stability during the summer was observed, when air temperature attained 40-41 C. Author

N71-36481# Texas Technological Univ., Lubbock.
OPTIMAL WORK-REST SCHEDULES UNDER PROLONGED VIBRATION
R. Dudek, M. M. Ayoub, and M. A. El-Nawawi [1970] 28 p refs Submitted for publication
(Contract DAAD05-69-C-0102)
(AD-726974) Avail: NTIS CSCL 05/5

Research was conducted for the purpose of studying the performance and recovery characteristics of men when subjected to low-level, whole-body vertical sinusoidal vibration for durations of one to two hours. Several male subjects performed a vertical compensatory tracking task using a CRT display according to three work-rest schedules under both normal and vibratory environments. The vibratory environment was that of vertical sinusoidal vibration with frequency of 5 cps and an amplitude of 0.08 inches resulting in an acceleration intensity of approximately 0.20 g. The working period was divided into equal intervals during which performance was continuously monitored. Decrement of performance was measured using absolute error score. Results and conclusions are presented regarding performance decrement and recovery under varying work-rest schedules. Optimum work-rest schedules and implications of control tasks under a vibratory environment are discussed. Author (GRA)

N71-36482*# Translation Consultants, Ltd., Arlington, Va.
MULTIPLE MOLECULAR SHAPES OF LACTATE DEHYDROGENASE (LDH) IN THE LYMPHOCYTES OF FETAL AND ADULT THYMUSES AND SPLEENS [FORME MOLECOLARI MULTIPLE DELLA LATTATO-DEIDROGENASI (LDH) NEI LINFOCITI TIMICI E SPLENICI FETALI ED ADULTI]
P. M. Mannucci et al Washington NASA Sep. 1971 11 p refs Transl. into ENGLISH from Minerva Med. (Turin), v. 57, 1966 p 997-999
(Contract NASw-2038)
(NASA-TT-F-13991) Avail: NTIS CSCL 06P

The activity of isoenzymes of lactate dehydrogenase (LDH) in fetal, neonatal, and adult human thymus and spleen lymphocytes were studies by electrophoretic and chromatographic methods. Cell preparations are outlined as well as LDH dosages. The multiple molecular shapes of LDH in the lymphocytes are discussed. J.M.

N71-36483*# National Aeronautics and Space Administration, Washington, D.C.
THE MICROBIOLOGIC CHARACTERIZATION OF SOIL TYPE '[DIE MIKROBIOLOGISCHE CHARAKTERISIERUNG VON BODENTYPEN]
W. Loub Oct. 1971 38 p refs Transl. into ENGLISH from Bodenkultur (Vienna), v. 11, 1960 p 38-70
(NASA-TT-F-13907) Avail: NTIS CSCL 06M

Soil types were characterized by microbiological sampling at monthly intervals, for at least one year, of various horizons of a cut at the site, down to a depth of about 50 cm. By plotting the numerical results of these cycles of mass changes, curves were obtained which give characteristic pictures of the soil types. Author

N71-36484# California Univ., Los Angeles.
STUDIES ON MAGNETIC FIELD EXPOSURES OF DROSOPHILA MELANOGASTER AND PELVETIA FASTIGIATA
Nancy Ann Posch (Ph.D. Thesis) 1970 145 p refs
(Grant MH-06415)
Avail: NTIS

A brief synopsis of the physics of magnetism and a discussion of the magnetic properties of biological materials are presented, in addition to a selected review of previous investigations into the biological effects of magnetic fields, as well as a discussion of hypothetical mechanisms to account for those effects. Two organisms were investigated. Pupae of the fruit fly, Drosophila melanogaster, were treated for brief periods by a magnetic probe, producing a magnetic field of high flux density and steep gradient. A method of permitting simultaneous exposure of numerous pupae to a magnetic field of high flux density and large values of magnetic field gradient is described. No effect of this treatment was found in the exposed organisms or their progeny. Embryos of the marine alga, Pelvetia fastigiata, were exposed to fields produced by a large electromagnet. The experiments indicated that the magnetic field produced a growth inhibition of embryonic development everywhere in the magnetic field, but the extent of growth inhibition increased as a function of increased field gradient. Author

N71-36485# Syracuse Univ., N.Y.
PRODUCTION OF AIR IONS AND OZONE BY BARLEY TIPS UNDER ELECTRIC FIELDS
Demetrios George Hademenos (Ph.D. Thesis) 1970 139 p refs Sponsored in part by NSF
Avail: NTIS

The effects of electric fields on the rate of growth of plants is discussed. An experiment involving the influence of air ions and ozone on various green plants is described. Charts are presented to show differences in growth rate under controlled conditions for various types of plants. P.N.F.

N71-36486*# Techtran Corp., Glen Burnie, Md.
THERMAL REGULATION DURING PHYSICAL EXERCISE: BEHAVIORAL APPROACH [THERMOREGULATION PENDANT L'EXERCICE MUSCULAIRE: APPROCHE COMPORTEMENTALE]
M. Cabanac et al Washington NASA Sep. 1971 4 p refs Transl. into ENGLISH from J. Physiol. (Paris), v. 62, suppl. 3, 1970 p 355-356
(Contract NASw-2037)
(NASA-TT-F-13972) Avail: NTIS CSCL 06P

The effects of exercise on the elevation of body temperature in the human body are discussed. During exercise periods, under controlled conditions, the subjects were permitted to vary the temperature of a cooling system to maintain the most agreeable temperature. On the basis of the experiments it is concluded that the human thermoregulatory apparatus is set for a constant temperature. Author

N71-36487# Joint Publications Research Service, Washington, D.C.
CHARACTERISTICS OF ELECTRIC RESPONSES OF THE COCHLEAR NUCLEI IN VESPERTILIONIDAE AND RHINOLOPHIDAE TO ULTRASONIC STIMULI WITH DIFFERENT FILL FREQUENCIES
A. G. Vasilyev 27 Sep. 1971 11 p refs Transl. into ENGLISH from Neyrofiziologiya (USSR), v. 3, no. 4, 1971 p 379-385
(JPRS-54133) Avail: NTIS

Summated electrical responses and action potentials of single neurons of the cochlear nuclei were studied in Vespertilionidae and Rhinolophidae. In both species of bats, the neuronal responses were similar to those recorded in the cochlear nuclei of other mammals. Rhinolophidae represent an exception insofar as three specific types of neurons were found in them: (1) neurons responding to frequencies up to 78 kilocycles or to the range of 80-90 kilocycles; (2) neurons reacting within the range of 40-90 kilocycles but insensitive to stimuli of 78-80 kilocycles; and (3) neurons which have a response change from tonic to phasic with changing fill frequency. The neurons of Rhinolophidae displayed maximum discrimination for frequencies within the range of 70-90 kilocycles. Author

N71-36488# Joint Publications Research Service, Washington, D.C.
EFFECTS OF ACCELERATION, HYPOKINESIA AND LOW CALORIE NUTRITION ON THE HUMAN ORGANISM
B. S. Katovskiy et al 22 Sep. 1971 11 p refs Transl. into ENGLISH from Vopr. Pitaniya (Moscow), no. 4, 1971 p 55-59
(JPRS-54104) Avail: NTIS

Six healthy subjects participated in a study of the effects of centrifugal acceleration and hypokinesia on the organism. The examinees were kept on a daily diet of 1800 calories/kilo. Extensive clinical-physiological investigations were conducted and then the examinees were rotated on the centrifuge (8 units -- 2 minutes) and were kept for 15 days on strict bed rest. At the end of the stay in bed, the examinees were again rotated on the centrifuge and the observations repeated. The combined effect of reduced nutrition, hypokinesia and crosswise-oriented accelerations caused several obvious functional disturbances of the central and peripheral nervous systems, blood circulation, respiration, neuro-muscular apparatus, especially pronounced during loading tests. It is assumed that the basic factor which causes unfavorable changes in the organism is hypokinesia but the limiting of nutrition and the effect of acceleration are concomitant effects. Author

N71-36489# Federal Aviation Agency, Oklahoma City, Okla. Civil Aeromedical Inst.
COLOR DEFECTIVE VISION AND DAY AND NIGHT RECOGNITION OF AVIATION COLOR SIGNAL LIGHT FLASHES
Jo Ann Steen and Mark F. Lewis Jul. 1971 15 p refs
(FAA-AM-71-32) Avail: NTIS

Comparisons of the efficiency of each of seven tests of color defective vision in predicting performance under day and night conditions are reported. In general, the commerical tests were less efficient in predicting performance at night than in the daytime. This reduction in efficiency may be attributed to an increase in the false alarm rate of each test. Author

N71-36490*+ National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 92)
Aug. 1971 120 p refs
(NASA-SP-7011(92)) Avail: NTIS CSCL 06E

Subject coverage concentrates on the biological, physiological, psychological, and environmental effects to which man is subjected during and following simulated or actual flight in the earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. Each entry consists of a standard citation accompanied by its abstract. Author

N71-36491*+ National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 93)
Sep. 1971 107 p refs
(NASA-SP-7011(93)) Avail: NTIS CSCL 06E

Subject coverage concentrates on the biological, physiological, psychological, and environmental effects to which man is subjected during and following simulated or actual flight in the earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. Each entry consists of a standard citation accompanied by its abstract. Author

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N71-36492*# Loewy (Raymond)/Snaith (William), Inc., New York.
EARTH ORBITAL SPACE STATIONS: HABITABILITY STUDY Final Report, Jan. 1970 - Mar. 1971
Mar. 1971 149 p
(Contract NASw-2058)
(NASA-CR-122924) Avail: NTIS CSCL 05E

Design concepts for Skylab space station are presented. Facilities for crew accommodation are emphasized. Subjects

discussed are: (1) food preparation, (2) sanitation, (3) garments and garment storage, (4) artificial gravity, and (5) extravehicular activity. P.N.F.

N71-36483*# General Dynamics/Fort Worth, Tex. Convair Aerospace Div.
DETERMINATION OF MEAN OPERATING LIFE AND SHELF LIFE FOR THE RADIATION SURVEY METER AND PERSONAL RADIATION DOSIMETER BATTERY PACKS
31 Jul. 1971 32 p ref
(Contract NAS9-11515)
(NASA-CR-115189; FZK-382) Avail: NTIS CSCL 06R

Tests to determine the mean operating life of four types of battery packs for use in two types of Apollo radiation measuring instruments, the personal radiation dosimeter (PRD) and the radiation survey meter (RSM) were completed. This battery pack operating life test was conducted to determine if the battery packs presently being used in the PRD and RSM units on the short Apollo missions (10 days) would operate properly for the much longer (56 days) Skylab missions. The results of these tests proved conclusively that the presently used PRD battery pack containing eight SA-1006/U mercury cells will not operate properly for the 56-day Skylab mission, but these tests also show that a battery pack containing eight PX-625 mercury cells will operate throughout the Skylab mission. Results also show that the two RSM battery packs that now contain eight RM-625R mercury cells each will not operate the RSM properly for a 56-day Skylab mission and neither will any of the other three types of mercury cells tested. Author

N71-36484*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AEROSPACE RELIABILITY APPLIED TO BIOMEDICINE
V. R. Lalli and D. J. Vargo 1971 26 p refs Presented at the Electron. Systems Conv., Washington, 6-8 Oct. 1971
(NASA-TM-X-67942; E-6621) Avail: NTIS CSCL 06B

An analysis is presented which indicates that the reliability and quality assurance methodology selected by NASA to minimize failures in aerospace equipment can be applied directly to biomedical devices to improve hospital equipment reliability. The space electric rocket test project is used as an example of NASA application of reliability and quality assurance methods. By analogy a comparison is made to show how these same methods can be used in the development of transducers, instrumentation and complex systems for use in medicine. Author

N71-36485*# Concept Applications, Ltd., Hempstead, N.Y.
HABITABILITY SYSTEM ENVIRONMENTAL REQUIREMENTS AND DESIGN GUIDELINES FOR GROUP STABILITY
Henry E. Bender and John Fracchia Aug. 1971 68 p refs
(Contract NAS9-10996)
(NASA-CR-115179) Avail: NTIS CSCL 05K

Guidelines and recommendations for habitability design are formulated to facilitate individual and group stability. These findings are based on reviews of previous studies involving persons in various terrestrial environments. Considerations were given to the NASA group model and properties of such a group. Author

N71-36486*+ Darling (R.E.) Co., Inc., Tucson, Ariz.
RESEARCH AND DEVELOPMENT OF UMBILICAL HOSE ASSEMBLY CONCEPTS FOR MANNED SPACE FLIGHT INCLUDING DESIGN VERIFICATION TEST REPORT REDAR-RTR-351 Final Report
W. A. Sylvester, R. C. Dougherty, and R. E. Darling, Jr. 30 Jul. 1971 56 p
(Contract NAS9-10396)
(NASA-CR-115157; REDAR-RSS-204) Avail: NTIS CSCL 06K

Several construction approaches using a variety of materials were evaluated to obtain a substantially improved umbilical hose assembly and PLSS oxygen and water hose. Flexibility and prevention of delamination were overriding design criteria. Author

N71-36487*+ Darling (R.E.) Co., Inc., Tucson, Ariz.
FINAL CONFIGURATION SELECTED FOR THE UMBILICAL HOSE ASSEMBLY AND LCG WATER SYSTEM
L. C. Fox 16 Jun. 1971 63 p
(Contract NAS9-10396)
(NASA-CR-115158; REDAR-RTR-351) Avail: NTIS CSCL 06K

This testing program verified the final design configuration of a new umbilical hose assembly. An add-on to the contract resulted in the development, construction, and design verification testing of the three hose assemblies used in the LCG water system. All of the hose assemblies successfully completed the design verification test program. The only damage to any hose assembly was an end cuff puncture of one umbilical hose assembly by the outside wire helix and during the 166 pound tensile load on a single leg bent 90 deg. Author

N71-36488*# International Business Machines Corp., Gaithersburg, Md. Federal Systems Div.
BREATHING METABOLIC SIMULATOR Final Report
16 Jul. 1971 22 p refs
(Contract NASw-2032)
(NASA-CR-122948; FSC-71-5133) Avail: NTIS CSCL 06B

The breathing metabolic simulator, designed to simulate the breathing and metabolic parameters relevant to the test and evaluation of breathing and life support equipment is described. Variable breathing rate, depth, and wave form are provided, as well as temperature control, functional residual capacity adjustment, and maintenance of humidity in the exhaled breath. Metabolic controls include variable oxygen consumption and carbon dioxide production resulting in a variable respiratory exchange ratio. Since the breathing metabolic simulator models all of the relevant breathing and metabolic functions, it can be used for calibrating and validating mechanical and gaseous pulmonary function test procedures. Author

N71-36489# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
HEALTH PHYSICS INSTRUMENTATION
George Cowper 1971 27 p
(AECL-3864) Avail: NTIS

Design features and operating characteristics of several radiation instruments for support of radiation protection are described. The instruments covered include a multipurpose survey meter, an alpha contamination monitor, a portable contamination monitor, high range gamma survey meters, beta radiation dose rate meters, and a portable tritium monitor as well as installed and area monitors, a criticality monitor, hand and foot monitors, automatic analyzers for tritium in urine and water, and an iodine-in-air monitor. A single channel scintillometer, health physics scaler, and personal dosimeters are also included. J.M.

N71-36500# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
THE EFFECTS OF DISPLAY GAIN AND SIGNAL BANDWIDTH ON HUMAN CONTROLLER REMNANT Final Report, 1 Jun. 1969 - 15 Aug. 1970
William H. Levison Wright-Patterson AFB, Ohio AMRL Mar. 1971 169 p refs
(Contract F33615-69-C-1684)
(AD-727057; BBN-1968; AMRL-TR-70-83) Avail: NTIS CSCL 05/8

A study was conducted to investigate visual sources of human controller remnant and to determine how various display and viewing parameters affect remnant. Principal experimental variables were display gain and signal bandwidth. Both foveal and peripheral viewing of the display were explored. The results of this study indicate that controller remnant can be modelled

adequately as an equivalent vector observation noise process. The effects of display gain and signal bandwidth on controller remnant can be accounted for by an optimal-control model of the entire man-vehicle system which includes the model for observation noise. Author (GRA)

N71-36501# Army Foreign Science and Technology Center, Charlottesville, Va.
CYBERNETICS EXPECTED AND CYBERNETICS UNEXPECTED
A. I. Berg et al 13 Jul. 1971 191 p Transl. into ENGLISH from "Kibernetika Ozhidaemaya i Kibernetika Neozhidannaya" Moscow, Nauka Publ. House, 1968
(AD-726970; FSTC-HT-23-747-70) Avail: NTIS CSCL 05/4

The document is a collection of articles by Soviet and non-Soviet scientists presented as a free discussion illuminating controversial and unsolved problems in cybernetics from different viewpoints. The authors of these papers oppose those who are against cybernetics as well as those who propose to substitute cybernetics for all other concrete and abstract sciences. Many of the articles deal with needed redefinitions in the area of cybernetics, with particular application to such terms as life, psyche, thinking machines, control of life, etc. Although many different viewpoints are presented, the book contains no fantasy which contradicts science but permits exercising the imagination without which scientific research is impossible. Author (GRA)

N71-36502# Navy Clothing and Textile Research Unit, Natick, Mass.
DAMAGE CONTROL SUIT SYSTEM Progress Report
Norman F. Audet Jun. 1971 36 p refs
(AD-726698; TR-95) Avail: NTIS CSCL 06/17

The Navy Clothing and Textile Research Unit is developing a Damage Control Suit System to protect personnel in hazardous chemical, high temperature-humidity, and oxygen deficient environments. Data indicate the system will provide life support for an individual completely encapsulated from his environment for a maximum of 80 minutes at 140F, while performing light activity, and for 120 minutes at 70F, while moderately active. GRA

N71-36503# Air Force Systems Command, Brooks AFB, Tex. Human Resources Lab.
QUANTIFYING HUMAN PERFORMANCE RELIABILITY
William B. Askren and Thaddeus L. Regulinski 29 Oct. 1971 18 p refs Presented at the Psychol. in the Air Force Symp., Colo., 20-22 Apr. 1971
(AD-727766; AFHRL-TR-71-22) Avail: NTIS CSCL 05/8

Human performance reliability for tasks in the time-space continuous domain is defined and a general mathematical model presented. The human performance measurement terms time-to-error and time-to-error-correction are defined. The model and measurement terms are tested using laboratory vigilance and manual control tasks. Error and error-correction data are ordered and the underlying density functions isolated. The Weibull distribution is best fit for time-to-first-error data, and the Log-Normal distribution is best fit for time-between-errors and time-to-error-correction data. Distribution parameter values are applied to the general mathematical model, and prediction made of human performance reliability for the tasks. GRA

N71-36504 Ohio State Univ., Columbus.
THE DEVELOPMENT OF A PERCEPTUALLY BASED MODEL OF THE HUMAN CONTROLLER
John Nunnelee Snider (Ph.D. Thesis) 1970 218 p
Avail: Univ. Microfilms Order No. 70-19364

An attempt was made to develop a model of the human operator which reflects known perceptual and response characteristics of man. The particular task around which this model was structured is that of the longitudinal control aspect of automobile driving. The resultant model predicts the response of the driver in controlling his vehicle as a function of the physical relationship between his vehicle and a leading vehicle, and the ability of the driver to perceive the state of the system. The model thus predicts driver behavior in performing this task on the basis of the driver's perceptual characteristics and observed response patterns. The model was tested with a digital simulation using data describing the perceptual and response characteristics of specific subjects. It was concluded that a model of the human controller may be formulated on the basis of observable characteristics of man. Such a model overcomes many of the limitations of the servomechanism model of the human operator. Dissert. Abstr.

N71-36505 Oregon State Univ., Corvallis.
PARAMETER ESTIMATION IN SYSTEM MODELING USING MAN-MACHINE INTERACTION AND COMPUTER LEARNING
John Arthur Wagner (Ph.D. Thesis) 1970 92 p
Avail: Univ. Microfilms Order No. 70-18068

An algorithm using man-machine interaction is presented to attack parameter search problems with the objective of efficiency in the parameter search. The algorithm presented uses computer learning to improve the parameter search efficiency. The algorithm is divided into a learning phase and a learned phase. In the learning phase the man teaches the computer his preferences for the model responses. Then in the learned phase the computer proceeds with the parameter search independently of the man by means of its experience acquired during the learning phase. After a period of learned model response evaluation by independent action of the computer in the learned phase the control of the parameter search process is returned to man. The problem of extracting features from model responses to train the computer is studied. A method to compare different feature extraction operations using entropy is presented. The algorithm is tested on an example oceanographic problem. Dissert. Abstr.

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N71-36506*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ELECTROPHORESIS SEPARATION IN SPACE: APOLLO 14
E. C. McKannan, A. C. Krupnick, R. N. Griffin, and L. R. McCreight 29 Aug. 1971 21 p refs Original contains color illustrations
(NASA-TM-X-64611) Avail: NTIS CSCL 07D

Fluid electrophoresis separation, based on the motion of particles in an electric field, was suggested as a promising process to make practical use of the near-zero-gravity condition in space. Hence, an apparatus was developed to demonstrate the principle and possible problems of electrophoresis on Apollo 14. It applied 30 volts per centimeter to samples of mixed red and blue dye, hemoglobin, and deoxyribonucleic acid, in aqueous solutions of boric acid. A filter system was provided to remove gas bubbles formed in the electrolyte. Photographs of the action in the tube indicated that the shape and sharpness of the separation boundary between the dyes was better in space than on earth. Difficulties with bacterial action precluded observation of the other samples, based on post-flight ground tests. Much was learned about the potential and the requirements of doing electrophoresis in space. Author

N71-36507*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif. Biotechnology and Power.
DESIGN AND FABRICATION OF A FLIGHT-CONCEPT PROTOTYPE ELECTROCHEMICAL WATER RECOVERY

SUBSYSTEM
David F. Putnam and Richard L. Vaughan Sep. 1971 91 p refs
(Contract NAS1-8954)
(NASA-CR-111961; MDC-G-2351) Avail: NTIS CSCL 07D

The final cell design can process the urine of a 12-man crew, weighs only 3.6 pounds, has no electrode separators or flow distribution screens, removes 99 percent of the organics, and uses power 20 percent more efficiently. Another advancement in the state-of-the-art is represented by the design of the electrodialysis stack, which can accommodate pressures as high as 50 psig without external leakage. A 30-day continuous around-the-clock test of the system conclusively demonstrated its self-sterilizing features, its ability to produce potable water, and the electrolytic pretreatment offers many advantages over the chemical pretreatments that are currently used. This technique eliminates the need for storage of corrosive pretreatment chemicals and enables higher yields of recovered water since solids are removed by the process. Author

N71-36508*# Rocket Research Corp., Redmond, Wash.
MONOLITHIC CATALYST BEDS FOR HYDRAZINE REACTORS Interim Report, 12 Nov. 1969 - 12 Apr. 1971
12 Apr. 1971 68 p refs Prepared for JPL
(Contract NAS7-755)
(NASA-CR-122644; IR-71-R-259) Avail: NTIS CSCL 07D

The Monolithic catalyst offers a single-piece catalyst bed as opposed to current catalysts which are packed into the reactor in granular form. It is hoped that the monolithic nature of the catalyst will result in reduced catalyst attrition as compared to present granular catalyst beds. Additionally, the monolithic catalyst offers the potential of increased bed conductivity, lower bed pressure drop and simplified reactor assembly procedures. After initial laboratory screening tests measuring foam metal compatibility with the exhaust gases, crust strength, pressure drop, active surface area, hydrogen chemisorption values, and ignition delay of candidate catalyst configurations, reactor tests were conducted under altitude conditions in a 2.2-N (0.5-lbf) thruster. Foam metal pore size, foam metal density, ceramic coating loading, and active metal loading were varied to optimize engine response and stability of operation. Results of this test program and problems encountered in ceramic material adherence to the foam metal as well as foam metal nitriding problems are discussed. A monolithic catalyst had been successfully tested in the 2.2-N (0.5-lbf) engine for an accumulated burn time of 7,700 seconds and 16 ambient temperatures starts. Catalyst condition at the end of this time was entirely satisfactory, with no sign of significant degradation. While not yet attaining the overall activity of Shell 405, the research gives promise that subsequent work will yield a catalyst of long-life potential. Author

N71-36509*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
THE MERCURY SENSITIZED OXIDATION OF CARBON MONOXIDE
R. Simonaitis and Julian Heicklen 2 Jun. 1971 43 p refs Submitted for publication
(Grants NGL-39-009-003; NSF GA-12385)
(PSU-IRL-SCI-370; NASA-CR-122937) Avail: NTIS CSCL 07D

The mercury-photosensitized oxidation of CO was studied at 275 C over a wide range of (O2)/(CO) ratios in the absence and presence of the O atom scavenger 2-trifluoromethylpropene (TMP) and at 25 C at low (O2)/(CO) ratios in the presence of TMP. By following the quantum yield of CO2 production, phi (CO2), as a function of the (O2)/(CO) ratio, the reactions of vibrationally excited CO and electronically excited O2, were studied. At low (O2)/(CO) ratios the predominant reactions are of vibrationally excited CO. Relative rate constants for chemical reaction versus deactivation of CO were obtained. At higher (O2)/(CO) ratios the principal reactions are of electronically excited O2. Relative rate constants for chemical reactions and deactivation of this electronically excited O2 with CO, O2 and TMP were obtained. From the effect of total pressure on phi (CO2) it is proposed that an intermediate CO3 is formed in the reaction of electronically excited O2 with CO. Author

N71-36510*# Electricity Council Research Center, Capenhurst (England).
ELECTROSYNTHESIS OF HYDRAZINE FROM GASEOUS AMMONIA. 4: CORRELATION OF EXPERIMENTAL RESULTS WITH COMPUTER CALCULATIONS
R. Barker Dec. 1970 38 p refs
(ECRC/N343) Avail: NTIS

A reaction scheme based on electron, atom and radical reactions was constructed to represent the chemical reactions occurring in a microwave discharge in ammonia. Simultaneous nonlinear differential equations expressing the concentration of the chemical species as a function of time were derived from the reaction scheme and solved numerically on a digital computer. There are fourteen reactions in the scheme and the rate constants of seven of these are known. The values of the rate constants of the other seven reactions were varied to try to obtain agreement between the calculated and (previously obtained) experimental product yields as a function of the residence time of the gas molecule in the discharge, power, gas pressure, and concentration of added allyl alcohol. The calculations quantify the conclusion that the major hydrazine destruction mechanism is electron-induced decomposition of NH2 and hydrazine. Therefore, in an ammonia discharge, hydrazine is destroyed at a faster rate than it is formed leading to very low concentrations in practicable quenching times. Author

N71-36511# Texas A&M Univ., College Station.
AN INVESTIGATION INTO THE DEVELOPMENT OF ELECTROPHORETIC AND ELECTROCHEMICAL WATER PURIFICATION SYSTEMS
William Madison Lyle (Ph.D. Thesis) Dec. 1970 128 p refs
Avail: NTIS

Suspended particulate matter such as clay, algae, and bacteria are troublesome pollutants in almost all waters and particularly in surface water. Electrophoretic and electrochemical systems appear well adapted for removal of these electrically charged pollutants and in addition have the potential of being entirely automated. Numerous design concepts are advanced and tested through the use of laboratory models. These include a parallel plate model which was designed entirely for electrophoretic removal, and porous filter and electrode grid models which incorporated both electrophoretic and electrochemical capabilities. Successful water clarification was attained with the parallel plate model only when the influent water was of very low electrical conductivity. Water purification by electrochemical means overcame this problem and was successful both operationally and economically. Author

N71-36512# California Univ., Los Angeles. School of Engineering and Applied Science.
EFFECT OF VOLUME FRACTION ON PARTICLE COARSENING: THEORETICAL CONSIDERATIONS
A. J. Ardell May 1971 30 p refs
(Contract AT(04-3)-34)
(UCLA-34-P-172-2; UCLA-ENG-7116) Avail: NTIS

The theory of diffusion-controlled particle coarsening developed by Lifshitz and Slyozov and Wagner (LSW) is modified to take into account the volume fraction of precipitate. The modification is based on the supposition that the diffusion of solute to a growing particle (or from a dissolving particle) will depend on a distance characteristic of the spatial distribution of the particles in the polydisperse assembly. The characteristic distance chosen for computational purposes is related to the mean free path between a particle and its nearest neighbor. While this is not the best choice, it serves to make the problem tractable analytically. Steady-state diffusion under conditions of spherical symmetry is also assumed. The modified LSW (MLSW) theory predicts that while the basic kinetics of the LSW theory are maintained, the coarsening rate increases with increasing

volume fraction, even at very small values of volume fraction. According to the MLSW theory, the theoretical distribution of particle sizes broadens rapidly at small values of volume fraction. In the limit volume fraction = 1 the theoretical particle size distribution becomes identical to that derived by Wagner for the case of interface controlled coarsening. All the results of the LSW theory are recovered from the MLSW theory in the limit of zero volume fraction. Author

N71-36513# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
STUDY OF MOLECULAR MOTIONS IN POLYMER SOLUTIONS BY PULSED NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY
Lawrence O. Goldstein (M.S. Thesis - Clemson Univ.) May 1971 60 p refs
(DP-MS-71-25) Avail: NTIS

Polymer and solvent motions in polymer solutions using spin-lattice and spin-spin relaxation measurements obtained by pulsed nuclear magnetic resonance as a function of temperature, concentration (in the 0.50 to 0.99 volume fraction of polymer range), and molar volume are discussed. Using deuterated polymer with protonated solvent and protonated polymer with deuterated solvent permits separate measurements of solvent and polymer molecules. Author (NSA)

N71-36514# Tennessee Univ., Knoxville.
LOW-TEMPERATURE FLUORINE CHEMISTRY Final Report, 3 Sep. 1968 - 31 May 1971
Gleb Mamantov and M. R. Clarke 15 Jul. 1971 48 p refs
(Contract F04611-69-C-0003)
(AD-727059; AFRPL-TR-71-79) Avail: NTIS CSCL 07/2

The program dealt with certain aspects of low-temperature fluorine chemistry of chlorine, nitrogen and oxygen. A new interhalogen radical, ClF2, was prepared and characterized through its infrared spectrum. At least one more new chlorine-fluorine species has been prepared by photolysis of Cl2/F2/Ar mixtures, but it was not identified. Low-temperature mass spectrometry of fluorine-containing compounds was studied using the cryogenic inlet system built for the Hitachi-Perkin-Elmer mass spectrometer. Author (GRA)

N71-36515# Chicago Univ., Ill.
THEORETICAL RESEARCH ON SURFACE PHYSICS AND CHEMISTRY Final Report
Robert Gomer and Morrel H. Cohen 1 Jul. 1971 5 p refs
(Grant AF-AFOSR-1332-67)
(AD-726653; AFOSR-71-1955-TR) Avail: NTIS CSCL 07/4

The research has dealt most directly with problems of surface physics and chemistry relating to the adsorption of polar or ionic adsorbates. Classical image force laws, the dielectric response of a semi-infinite degenerate electron gas, and the energy distribution in field emission in the presence of adsorbates. Details of the work are given in published journal articles cited in the report. Author (GRA)

N71-36516# California Univ., La Jolla. Dept. of Chemistry.
THE RELATIONSHIP BETWEEN THE HARD SPHERE FLUID AND FLUIDS WITH REALISTIC REPULSIVE FORCES
John D. Weeks, Hans C. Andersen (Stanford Univ.), and David Chandler (Ill. Univ., Urbana) 1971 41 p refs Sponsored in part by NSF and Am. Chem. Soc.
(Contract N00014-69-A-0200-6018; ARPA Order 1479)
(AD-726763; TR-7) Avail: NTIS CSCL 07/4

The study considers the equilibrium statistical mechanics of classical fluids in which the potential energy is resolvable into repulsive pair interactions. A generalized cluster expansion is derived relating the thermodynamic and structural properties of such systems to those of the hard sphere fluid. The expansion is ordered by a softness parameter which is essentially the range of intermolecular distances in which the difference between the Mayer functions for the repulsive potential and an appropriate reference hard sphere potential is non-zero. The first (lowest order) approximation generated by the expansion equates the free energy and distribution function for the fluid to the respective functions appropriate to a system of hard spheres with diameter d. A prescription is given for choosing a temperature and density dependent diameter d of the reference hard sphere fluid so that the first approximation for the free energy contains errors of one order only. With this approximation, the results obtained for both model systems agree closely with those obtained by Monte Carlo calculations. Author (GRA)

N71-36517# Battelle Memorial Inst., Columbus, Ohio.
ANOMALOUS WATER AND OTHER POLYMERIC MATERIALS Semiannual Technical Report, 15 Dec. 1970 - 15 Jun. 1971
Thomas F. Page and R. J. Jakobsen 15 Jul. 1971 101 p refs
(Contract DAAH01-71-C-0491; ARPA Order 1463)
(AD-726761) Avail: NTIS CSCL 07/2

During the preparation of anomalous material from water, a residue is found in the capillary tubes even though the tubes themselves had been cleaned prior to the preparation. The total quantity of elements other than H and O is smaller for the preparations from cleaned tubes than either the first tube washings with water or the preparations from uncleaned tubes. All of the elements found to be present in either the water washings of capillary tubes or in preparations from uncleaned tubes were detected in the preparations from cleaned tubes. All tube washings and preparations give roughly equivalent infrared spectra. However, there are distinct and consistent difference in the exact frequencies of these absorption bands between the spectra of liquid water tube washings and the spectra of anomalous material preparation, whether from cleaned or uncleaned tubes. Preparation of anomalous material from 3 percent H2O2 solutions gave a material with an infrared spectrum which differed in some frequencies from the spectrum of preparations from 100 percent H2O. Three groups of water extractions of crushed glass give spectral differences which are reflected by changes in elemental composition. Author (GRA)

N71-36518*# Wisconsin Univ., Madison. Theoretical Chemistry Inst. and Physics Dept.
THE VARIATION METHOD. 1
Saul T. Epstein 19 Feb. 1971 141 p refs
(Grants NGL-50-002-001; NSF GP-12832)
(NASA-CR-122953; WIS-TCI-431) Avail: NTIS CSCL 07D

The general approximation method based on the variation principle is discussed in detail and is applied to the binding energy of atoms and molecules. The linear variation method is developed, and self consistent field methods are described in general and the Hartree-Fock approximations in particular. Special theorems are also discussed which are satisfied by optimal trial functions, such as hypervirial, generalized Hellmann-Feynman, momentum, force, torque, and virial theorems. N.E.N.

N71-36519# Bureau of Mines, Tuscaloosa, Ala. Tuscaloosa Metallurgy Research Lab.
COMPUTER CALCULATION OF BINARY ORGANIC LIQUID RECOVERY BY CONDENSATION FROM MIXTURES OF BINARY ORGANIC VAPOR AND AIR
John P. Gooch and James S. Browning 1971 85 p refs
(BM-RI-7563) Avail: NTIS

A computer program has been written which calculates the saturation curves and condensation characteristics of gaseous mixtures consisting of binary organic vapor and air. The program employs an algorithm which assumes an equilibrium mechanism for condensation, and the degree of fractionation obtained is predicted on the basis of relative volatility. The program incorporates a feature which allows the user to examine the fractionation resulting from condensation as a function of the size of the temperature increments over which condensation is

assumed to occur. If a single temperature interval between the dewpoint of the mixture and the outlet temperature of the condenser is assumed for the calculation, the results obtained will be those resulting from a single equilibrium condensation. If the condensation is assumed to occur over a number of temperature increments, the results obtained will approach those predicted by the Rayleigh equation as the magnitude of the temperature increments approaches zero. The results from calculations performed on vapor mixtures from organic heavy liquid solutions used in beneficieting potash and brucite ores are presented. Author

N71-36520*# Stanford Research Inst., Menlo Park, Calif.
STUDY OF MECHANISMS CONTROLLING THE ULTRAVIOLET PHOTOCHEMISTRY OF ASSOCIATED AND POLYMERIC SYSTEMS Final Report, 20 Apr. 1970 - 9 Apr. 1971
Michael Anbar and G. A. St. John Washington NASA Oct. 1971 59 p refs
(Contract NAS2-5937)
(NASA-CR-1935) Avail: NTIS CSCL 07D

Liquid water and alcohols were shown to undergo photoionization when subjected to vacuum ultraviolet in the range 210-180 nm. Hydrated electrons were identified as the products of photolysis in liquid water by a number of characteristic reactions using competition kinetics as a quantitative criterion. The reactions e(-)aq + SF6, e(-)aq + H3O(+) and e(-)aq + Cd were used as the principle analytical tools of investigation. The photoproduction of electrons was shown to be the result of a single photon process. A parallel investigation of the photodissociation of water to H + OH suggests that photoionization and photodissociation of liquid water involve the same excited state; the cross section for photodissociation is about ten times larger than for photoionizations. Photoionization of liquid water occurs at energies significantly (> 6.5 eV) below the ionization potential mainly by solvation of the positive ion, H2O(+) though the formation of excimers should also be considered. Author

N71-36521# Toledo Univ., Ohio. Dept. of Chemical Engineering.
A STUDY OF THE ADDUCTIVE CRYSTALLIZATION MECHANISM
Leslie E. Lahti Sep. 1971 31 p refs
(UTCHE-7111) Avail: NTIS

A dilatometric technique was developed which was employed to illustrate that the only effective adductive nucleation catalyst was the crystal itself. It was also used to explore the role of the solvent in crystallization suggesting that in addition to tye concentration, viscosity and dielectric constant were very important in nucleation and that various surfaces influence nucleation, implying a heterogeneous mechanism. The dilatometric technique was shown to be a poor device for determining solubilities of urea adducts. A drying technique under vacuum was shown to be better for determining solubilities of urea in various solvents. An initial kinetic study showed that the adduction rate was dependent on urea concentration but not on paraffin concentration. Author

N71-36522 National Lending Library for Science and Technology, Boston Spa (England).
THE VISCOSITY OF CO2 BETWEEN 293 K AND 1500 K
G. C. Maitland (Oxford Univ., England) et al 13 Apr. 1971 4 p refs Transl. into ENGLISH from J. Chim. Phys. (Paris), v. 67, no. 3, 1970 p 631-632 In ENGLISH and FRENCH
(NLL-Risley-Trans-2129-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Measurements of CO2 viscosity relative to N2 viscosity were made using a capillary flow method. Between 293 and 450 K a Pyrex capillary with inside diameter of 0.03 cm was used, between 450 and 1100 K a silica capillary with an i.d. of 0.044 cm was used, and above 1100 K the capillary was platinum/20% rhodium and had an i.d. of 0.37 cm. The ratios of viscosities of CO2 to N2 and the viscosity coefficients of each gas are tabulated. The values are consistantly higher than most published results, and it is concluded that there are considerable errors in the literature in the high temperature viscosities for carbon dioxide. N.E.N.

N71-36823 National Lending Library for Science and Technology, Boston Spa (England).
ISOTOPE SEPARATION BY ION EXCHANGE
28 Apr. 1971 8 p Transl. into ENGLISH from Inform. Chim. (Paris), no. 93, Feb. 1971
(NLL-Risley-Trans-2135-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The advantages and use of ion exchange resins for the separation of boron, nitrogen, and uranium isotopes is reviewed. Geseous diffusion and the ultracentrifuge are also discussed. J.G.M.

N71-36824 National Lending Library for Science and Technology, Boston Spa (England).
CATALYTIC ACTIVITY OF OSMIUM ELECTRODE-CATALYSTS
A. A. Sutyagina et al 17 Mar. 1971 6 p refs Transl. into ENGLISH from Vestn. Mosk. Univ. Ser. 2 (Moscow), v. 11, no. 3, 1970 p 314-316 In ENGLISH and RUSSIAN
(NLL-LTI-746-719; NLL-LTI-734-6518) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The evaluation and comparison of the catalytic activity of electrodeposited catalysts is presented. The dependence of the activity of osmium plated electrodes on the weight and thickness of the deposited osmium during the reaction of hydrogenation and electro-reduction of nitromethane was investigated. The amount of adsorbed hydrogen changes linearly with an increase of the weight of the deposited osmium. Author

N71-36825 National Lending Library for Science and Technology, Boston Spa (England).
CALCULATION OF THE NUMBER OF THEORETICAL EXTRACTION STAGES IN THE COMBINED EXTRACTION OF SOME MACRO-COMPONENTS WITH TRI-N-BUTYLPHOSPHATE (WITH REFERENCE TO THE EXAMPLE OF NITRIC ACID, URANYL NITRATE, AND TETRAVALENT PLUTONIUM NITRATE)
A. S. Solovkin et al 1971 19 p Transl. into ENGLISH from Zh. Prikl. Khim. (Moscow), v. 43, no. 9, 1970 p 1998-2004 In ENGLISH and RUSSIAN
(NLL-Windscale-456-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The extraction of macro-quantities of nitric acid, uranyl nitrate, and trivalent plutonium nitrate; and micro-quantities of zirconium with tri-n-butylphosphate dissolved in kerosene is discussed. Calculations of the number of theoretical stages of extraction are outlined for the combined extraction of the macro components. An extraction constant is developed and utilized in the calculations. J.M.

N71-36826 National Lending Library for Science and Technology, Boston Spa (England).
DEPENDENCE OF PEAK SHAPES IN GLC ON THE RETENTION TIME, SAMPLE VOLUME AND TYPE OF COLUMN
J. Baudiech et al 10 Mar. 1971 15 p refs Transl. into ENGLISH from Chromatographia (West Germany), v. 3, no. 10, 1970 p 469-477
(NLL-CE-Trans-5678-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

In view of the peak-area-allocation of overlapping peaks, peak shapes and variations in retention were studied on different gas-liquid chromatographic columns with respect to concentration and type of solute. Though peak starts and half-height widths vary only slightly with changing concentrations, the peak-maxima show distinct shifts, due to concentration and

retention time. This effects great variations in the symmetry indices (ratio of ascent to descent). A region of extreme curvature at 1 to 3 % peak-height was found on the descent of reverse peaks (slow ascent and steep descent), after which a pronounced tailing occured. The tailing magnitude as well as the point of maximum bend is not predictable from the peak shape, and thus prevents an exact area allocation. Author

N71-36527 National Lending Library for Science and Technology, Boston Spa (England).
EFFECTIVENESS FACTOR OF NONISOTHERMAL CATALYSTS TAKING INTO CONSIDERATION THE INFLUENCE OF MASS AND HEAT TRANSFER AT THE BOUNDARY FILM AND IN THE INTERIOR OF THE PARTICLES
S. Goto et al Jun. 1971 14 p refs Transl. into ENGLISH from Kagaku Kogaku (Japan), v. 31, no. 1, 1967 p 82-87
(NLL-RTS-6472) Avail: Natl. Lending Library, Boston Spa, Engl.: £1.30; 4 NLL photocopy coupons

A method for determining the effectiveness factor of nonisothermal catalysts is presented taking into account boundary film effects. Mass and heat transfer at the boundary film and in the interior of the particles are included and calculated results are given. A method of estimating the influence of the boundary film alone is also proposed. J.M.

N71-36528 National Lending Library for Science and Technology, Boston Spa (England).
INVESTIGATION OF MIXED ADSORPTION HYDROGENATION CATALYSTS. 16: Rh-Pt AND Rh-Pd CATALYSTS ON SILICA GEL [ISSLEDOVANIE SMESHANNYKH ADSORBTSIONNYKH KATALIZATOROV GIDRIROVANIYA]
A. A. Alchudzhan et al May 1971 10 p refs Transl. into ENGLISH from Arm. Khim. Zh. (USSR), v. 23, no. 1, 1970 p 3-8
(NLL-RTS-6448) Avail: Natl. Lending Library, Boston Spa, Engl.: £0.90; 3 NLL photocopy coupons

The kinetic activity of Rh-Pt/SiO2 and Rh-Pd/SiO2 catalysts in the benzene hydrogenation reaction was investigated. With an increase in the content of platinum in Rh-Pt/SiO2 catalysts, the activity sharply increased. The activity of the jointly applied Rh-Pt/SiO2 catalyst was appreciably greater than the additive activity of the Rh/SiO2 and Pt/SiO2 catalysts containing the same amounts of rhodium and platinum. The activity of the Rh/SiO2 catalyst was suppressed by the catalytically active palladium in the same reaction. Author

N71-36529 National Lending Library for Science and Technology, Boston Spa (England).
ANODIC DISSOLUTION OF NICKEL SULPHIDES
I. S. Ivanov et al Dec. 1970 9 p refs Transl. into ENGLISH from Tr. Proektn. i Nauchn.-Issled. Inst. "Gipronikel" (Gos. Proektn. i Nauchn.-Issled. Inst. Nikelevo-Kobaltovoi i Olovyannoi Prom.), Leningrad, no. 38, 1968 p 71-88 In ENGLISH and RUSSIAN
(NLL-Trans-746-699-(9022.401); NLL-LTI-734-6438) Avail: Natl. Lending Library, Boston Spa, Engl.: 3 NLL photocopy coupons

The anodic nickel sulfide dissolution process in the sulfide electrode is discussed. The migration of nickel ions in the sulfide lattice was investigated including electric field effects and crystalline structural changes. Polarization potential measurements were made of nickel sulfides with different compositions as functions of time and polarizing current density. Three stages of dissolution, depending on the current density were observed and are described. The lattices in the surface layers were examined by X-ray analysis. Vacancy concentration effects on polarization changes are summarized. J.M.

07 COMMUNICATIONS

Includes communications equipment and techniques, noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N71-36530*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DIGITAL COMMAND SYSTEM SECOND-ORDER SUBCARRIER TRACKING PERFORMANCE
Jack K. Holmes and Carl R. Tegnelia 1 Oct. 1971 12 p refs (Contract NAS7-100)
(NASA-CR-122776; JPL-TR-32-1540) Avail: NTIS CSCL 17B

Equations are derived for the timing performance of the all-digital, second order, phase-locked loop proposed for the Viking Orbiter and TOPS programs. The theory is compared with experimental results and found to agree well over the range of interest. Author

N71-36531*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOME CHARACTERISTICS OF MICROWAVE TYPE 4 RADIO BURSTS AND THE ACCELERATION OF SOLAR COSMIC RAYS
Kunitomo Sakurai Sep. 1971 11 p refs
(NASA-TM-X-65701; X-693-71-379) Avail: NTIS CSCL 20N

The acceleration processes of solar cosmic rays produced by solar flares were investigated. The results of observational data on solar cosmic events and microwave type 4 radio bursts are discussed, and summarized in graphs. It is concluded that the rapidity of electron acceleration is closely related to the acceleration process of protons and heavier nuclei during the explosive phase. F.O.S.

N71-36532*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va. ElectroScience Lab.
A STUDY OF THE NEAR FIELDS OF REFLECTOR ANTENNAS USING THE GEOMETRICAL THEORY OF DIFFRACTION
William Charles Roberts-Horsfield, III Aug. 1971 69 p refs (Contract NAS1-10040)
(NASA-CR-111950) Avail: NTIS CSCL 09C

A technique for calculating the near fields of reflector antennas using the geometrical theory of diffraction (GTD) is developed. Computed patterns for two antennas are compared with patterns obtained by other techniques and experimental data. The GTD is proved to be a useful tool in obtaining near field patterns of antennas. Author

N71-36533# Australian Post Office Research Labs., Melbourne. Radio Propagation Div.
FOUR GHz PROPAGATION MEASUREMENTS ON A LONG HIGH CLEARANCE PATH, DUNN'S HILL-LOCH Final Report, Jun. 1962 - Jul. 1963
R. A. Harvey Jun. 1970 17 p
(Rept-6124) Avail: NTIS

The Dunn's Hill-Loch path, of length 40.4 miles, between high terminals with a very flat reflection area between, had a path difference between direct and ground reflected rays of about fifty wavelengths at 4 GHZ. Received signals fluctuated continuously with a peak to trough variation of between 8 and 15dB. This fading was probably due to small changes in refractive index gradient, sufficient to swing the interference pattern trough one or more fringes. Occasional deep minima and bursts of spiky fading occurred which were consistent with either multipath propagation or a phase fluctuation between the direct and reflected rays. Fading was worst during summer, but no

diurnal trend was apparent. Vertical space diversity gave, for the signal level exceeded for 99.99% of the time, an improvement of at least 10dB over a single antenna. Author

N71-36534# Technische Hochschule Munchen (West Germany). Fakultaet fuer Maschinenwesen und Elektrotechnik.
CONCERNING THE SIGNIFICANCE OF CONTRAST DISTORTION ON TELEVISION [UEBER DIE BEDEUTUNG DER GRADATIONSVERZERRUNGEN BEIM FERNSEHEN]
Detlev Torenburg (Ph.D. Thesis) 1971 21 p refs In GERMAN
Avail: NTIS

Grading distortions are nonlinear irregularities in the luminous density distribution of the television picture in comparison with the luminous density distribution in the actual scene. Performed tests with human subjects established that the intensity of observed television picture details depends on their luminous density as well as on the adaptability of the eye in recognizing relative brightness level characteristics.
Transl. by G.G.

N71-36535# Technische Hochschule Munchen (West Germany). Fakultaet fuer Maschinenwesen und Elektrotechnik.
AMPLITUDE MODULATION AND PHASE MODULATION BY FREQUENCY MULTIPLIERS WITH VARACTOR DIODES [AMPLITUDEN- UND PHASENMODULATION BEI FREQUENZVERVIELFACHERN MIT VARAKTOR DIODEN]
Aleksandar M. Markovic (Ph.D. Thesis) 1970 22 p refs In GERMAN
Avail: NTIS

Calculated are optimal linearities for amplitude modulation and maximal initial lift for phase modulation by various frequency multipliers with varacter diodes. Defined are capacitance variations and drive level increases in relation to the individual varactor frequency multiplier systems. Transl. by G.G.

N71-36536# Technische Hochschule Munchen (West Germany). Fakultaet fuer Maschinenwesen und Elektrotechnik.
THE SHORT RANGE FIELD OF RECEIVING ANTENNAS [DAS NAHFELD VON EMFANGSANTENNEN]
Bernd Mueller (Ph.D. Thesis) Feb. 1971 23 p refs In GERMAN
Avail: NTIS

Linear superimposition of intensity components from two electromagnetic fields is used to study the energy flow in the near field of receiving antenna. One field represents the impinging wave propagating to the receiver, and the other field comprises the scattered wave at the receiver. The scattered field is calculated from the current on the receiver and the propagating field is considered level. Solutions for the field line differential equations provide electrical and magnetic field line distributions and their perspective representations. Time dependent Poynting vectors project the energy transport in the scattered field. Constant phase lines of the electric and magnetic field strengths develop regions of shadow effects or extinction in the short range field of the receiving antenna. Transl. by G.G.

N71-36537# Joint Publications Research Service, Washington, D.C.
WIDEBAND COMMUNICATIONS SYSTEMS
14 Sep. 1971 15 p refs Transl. into ENGLISH from Izv. Vuzov SSSR, Radioelektron. (Moscow), v. 14, no. 6, 1971 p 601-606 and 633-639
(JPRS-54044) Avail: NTIS

CONTENTS:
1. CONDITIONS FOR WIDEBAND EXCITATION OF HYPERSONIC WAVES A. B. Vlasov et al p 1-6 refs (See N71-36538 23-07)
2. APPLICATION OF THE THEORY OF WIDEBAND COMMUNICATIONS SYSTEMS TO CONTINUOUS SIGNALS K. B. Chelyshev et al p 7-14 refs (See N71-36539 23-07)

N71-36538# Joint Publications Research Service, Washington, D.C.
CONDITIONS FOR WIDEBAND EXCITATION OF HYPERSONIC WAVES
A. B. Vlasov et al *In its* Wideband Commun. Systems 14 Sep. 1971 p 1-6 refs (See N71-36537 23-07)
Avail: NTIS

Requirements for the conditions producing wideband excitation of hypersonic waves are discussed. Excitation of wave shifts in piezocrystals is described. The shifts are characterized by minimum dispersal speed and are accompanied by a large signal lag. Numerical analyses of the waveshift requirements and mathematical models of the design parameters are reported.
Author

N71-36539# Joint Publications Research Service, Washington, D.C.
APPLICATION OF THE THEORY OF WIDEBAND COMMUNICATIONS SYSTEMS TO CONTINUOUS SIGNALS
K. B. Chelyshev et al *In its* Wideband Commun. Systems 14 Sep. 1971 p 7-14 refs (See N71-36537 23-07)
Avail: NTIS

The concept of a wideband continuous signal is introduced. An example of a signal obtained by amplitude-frequency modulation is presented. Numerical analyses and mathematical models are used to describe the conditions of wideband communication. Author

N71-36540# Lockheed Missiles and Space Co., Palo Alto, Calif.
CW RADAR STATIONS
V. V. Grigorin-Riabov, ed. [1971] 24 p refs Transl. into ENGLISH from the book "Radiolokatsionny Ustroistva (Teoriia i Printsipy Postroeniia)" Moscow, Sov. Radio Press, 1970 p 392-425
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The advantages and disadvantages of CW radar are compared with pulse units. Some factors considered include: the detection of moving targets and the suppression of passive interference, determination of target velocity, constraints on the limiting velocity, and the complexity of operation and display. The operating principles and some characteristics of different kinds of CW radars are discussed. J.G.M.

N71-36541# Air Force Cambridge Research Labs., Bedford, Mass. Ionospheric Physics Lab.
RAY TRACING IN THE TROPOSPHERE, IONOSPHERE AND MAGNETOSPHERE
Ming S. Wong 1 Jun. 1971 14 p refs *Its* Environmental Research Papers No. 357
(AD-726997; AFCRL-71-0317; AFCRL-ERP-357) Avail: NTIS CSCL 20/14

Ray patterns are presented which delineate the propagation of radio signals to large distances by ducting under super-refracting conditions in the troposphere, ionosphere, and magnetosphere. The unity of ducting is emphasized in the sense that the ducts, whether they occur in the troposphere, ionosphere, or magnetosphere, all have formally similar features. This unity follows from the circumstance that the rays which propagate to large distances are those which graze a super-refracting layer at shallow glancing angles and which generally traverse only those regions of the propagation medium where the refractive index deviates but slightly from the free-space value. Author (GRA)

N71-36542# Naval Research Lab., Washington, D.C.
PROCEEDINGS OF THE SYMPOSIUM ON APPLICATIONS OF WALSH FUNCTIONS
R. W. Zeek and A. E. Showalter 1971 228 p refs Presented at the 1971 Symp., Washington, D. C., 13-15 Apr. 1971 Prepared in cooperation with Maryland Univ. and IEEE

(AD-727000) Avail: NTIS CSCL 09/4

The objective of the symposium is to show the progress in theoretical and experimental work since last year's meeting with the hope that it will help further advance the use of Walsh and similar functions from the academic level to the level of practical use. The main objective is to determine if substantial benefit in equipment performance, reliability and other factors can be obtained from the application of these functions to such important areas as filtering of signals, computer signal processing, voice signal compression, multiplexing, spectrometry, and many others. Author (GRA)

N71-36643# Stanford Univ., Calif. Electronics Labs.
LDES, HOAXES, AND THE COSMIC REPEATER HYPOTHESIS
O. G. Villard, Jr., A. C. Fraser-Smith, and R. P. Cassam May 1971 13 p refs
(Contract N00014-67-A-0112-0068; ARPA Order 1733)
(AD-726735; SU-SEL-71-030; TR-2) Avail: NTIS CSCL 20/14

Thirty-eight additional radio amateur reports of the long-delayed echo (LDE) effect are listed, bringing the grand total to 90 in this reported series. ('Long' in this connection means an 'echo' lasting for more than two seconds.) Although detection of an LDE is apparently a rare event, they do occur and determination of the causative mechanism may prove of value in future communication techniques. A new manifestation of the effect is reported here for the first time. It is a situation in which the only communication path between a given transmitter and a certain receiver behaved as if it contained a delay of several seconds. (There was no 'echo', as such, to attract attention). If confirmed by similar observations, this report represents an important clue as to the causative mechanism. As further evidence of the reality of the LDE effect, the article reproduces an original log entry describing a typical LDE observed in Australia in 1937. Hoaxes, and their recognition, are discussed. In the authors' view, the extra-terrestrial-origin hypothesis in explanation of the very long delays is at the moment as plausible as any other. Author (GRA)

N71-36644# Army Electronics Command, Fort Monmouth, N.J.
RADIO POLARIZATION MODULATION
Kurt Ikrath May 1971 124 p refs
(AD-726845; ECOM-3421) Avail: NTIS CSCL 20/14

A theoretical analysis is given of transmission, reflection, and scatter of polarization modulated radio waves. Practical implications for communications and surveillance are discussed. Author (GRA)

N71-36645# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PARAMETER ESTIMATION, DETECTION AND DISCRIMINATION OF SIGNALS
L. P. Sysoev 31 Mar. 1971 293 p refs Transl. into ENGLISH of the book "Otsenki Parametrov, Obnaruzhenie i Razlichenie Signalov" Moscow, 1969 p 1-230
(AD-726814; FTD-HC-23-509-70) Avail: NTIS CSCL 09/4

The document is devoted to the methods of optimal signal reception in the presence of noise. At the beginning, the book briefly discusses the fundamental notions of estimation theory, describes the least squares methods, maximum likelihood methods, and the Bayes estimates. A definition of the optimal estimates is given. The book then gives the solution of the problems of constructing optimal estimates of unknown parameters for various types of received signals. It discusses the cases of signals of known type which depend nonlinearly on unknown parameters and which are received in additive and nonadditive noise, as well as signals which are random processes and depend on unknown parameters. Methods of finding optimal estimates are also given for the cases of many observed signals. The book discusses the theory of signal detection, and gives methods of constructing optimal single-channel and multiple-channel systems of detecting useful signals of known form, useful signals dependent on random parameters, and useful signals which are random processes. It discusses in detail the problem of detecting Gaussian signals received at discrete moments of time by many channels. It proposes a method of determining a detection system which considerably reduces the volume of calculations. Author (GRA)

N71-36646# North Carolina State Univ., Raleigh. Dept. of Electrical Engineering.
DELAY ADAPTIVE DIFFERENTIAL PULSE CODE MODULATION SYSTEM
Ying Hui Shih 25 Apr. 1971 230 p refs
(Contract F44620-69-C-0033)
(AD-726868; AFOSR-71-1934TR) Avail: NTIS CSCL 09/4

A delay adaptive differential pulse code modulation system, consisting of a delay adaptive predictor and a delay adaptive quantizer, is investigated. These components are first analyzed separately, and then in combination, using a stationary Gaussian Markov signal. They employ a buffer to store a segment of the signal at a time. Parameters are computed from each segment, and then used to encode this segment. It is shown that the delay adaptive can achieve a significantly lower mean square prediction error than the analogous nonadaptive predictor. A technique of delay adaptive quantization, in which the levels of a core quantizer are scaled in proportion to the local r.m.s. value of the signal, is described and analyzed. The signal-to-quantizing noise ratio of the delay adaptive differential pulse code modulation system is obtained. For small learning periods, this SNR is very close to a general upper bound for digital encoding systems. Finally, the transmission of the adaptive parameters to the receiver is considered. The parameters must be quantized; uniform quantizers are employed. The SNR is obtained as a function of total channel bit rate and compared to a bound for nonadaptive DPCM. The system performs quite well for learning periods larger than about fourteen samples. Author (GRA)

N71-36647# Queens Univ., Kingston (Ontario). Dept. of Electrical Engineering.
ERROR ANALYSIS OF EQUALIZERS FOR DIGITAL TRANSMISSION BY PAM
P. J. McLane Jul. 1971 50 p refs Sponsored in part by Federal Dept. of Communications and Natl. Res. Council of Can.
(RR-71-2) Avail: NTIS

A standard receiver for the demodulation of digital pulse amplitude modulated (PAM) signals is a series connection of a low pass filter, a sampler, and a tapped delay unit. First, a model is obtained for data transmission via digital PAM and the signal reception. The model operates in real time and is completely causal. Secondly, upper and lower bounds are developed for the probability of digit error of the model. The idea is to effectively calculate the digit error by bounding it, above and below, with simple expressions. The upper bound is based on the Chernoff bound and a decomposition of the error expression. The lower bound is based on Jensen's inequality. Results are presented for three channels having exponential impulse responses. The error bounds in these cases are very tight and indicate that the model and bounds are of much use in digital transmission studies. Author

N71-36648*# Old Dominion Univ. Research Foundation, Norfolk, Va. School of Engineering.
DOPPLER RADAR SIMULATION STUDIES
William D. Stanley Winshington NASA Oct. 1971 121 p refs
(Grant NGR-47-003-015)
(NASA-CR-1776) Avail: NTIS CSCL 17I

A study of digital simulation and possible implementation techniques for Doppler radar altimeter signal processing is presented. A technique is described for generating simulated Doppler signals by employing a random number generator and a digital filter. Representative Doppler spectra are presented and are used in studying the measurement techniques considered. The development of a digital phase-locked concept is given. The simulation of such system on a digital computer is developed, and suggestions for possible implementation are presented. A

study of processing Doppler signals with a fast Fourier transform spectrum processor is presented. Results of a computer simulation of a processor are discussed, and representative processed Doppler spectra are included. Author

N71-36548# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ORBITA TELEVISION DISTRIBUTION SYSTEM: STATUS AND DEVELOPMENT
L Ya. Kantor 29 Jan. 1971 11 p refs Transl. into ENGLISH from Proceedings of 4th Colloq. on Microwave Commun., Budapest, 21-24 Apr. 1970
(AD-727448; FTD-HT-23-75-71) Avail: NTIS CSCL 17/2

The article deals with the principle characteristics of the 'Orbita 2' satellite distribution system for television, data, newsprint and facsimile, multichannel telephony, and radio-broadcasting transmission. Antenna system, TV reception equipment, audio systems, and duplex telephony apparatus are discussed. Author (GRA)

N71-36550# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A HIGH PRECISION MEASURING TELEVISION SYSTEM
N. I. Berlin et al 15 Mar. 1971 13 p refs Transl. into ENGLISH from Tekhn. Kino Televideniya (USSR), v. 14, no. 3, 1970 p 43-44
(AD-727172; FTD-MT-24-333-70) Avail: NTIS CSCL 09/2

Considered are the principles of designing a flying spot television system for information transmission into computer. The system insures the accuracy of calculating coordinates through the whole image field not worse than 0.005 percent with respect to its dimensions. Author (GRA)

N71-36551# Raytheon Co., Wayland, Mass. Equipment Development Labs.
DOPPLER SIGNAL PROCESSING AND INSTRUMENTATION FOR MODIFIED PORCUPINE C-BAND PULSE DOPPLER RADAR Final Report, 1 May 1968 - 30 Apr. 1971
Ronald B. Campbell, Frederick E. Compton, Victor Friedmann, and Herbert L. Groginsky May 1971 88 p refs
(Contract F19628-68-C-0345)
(AD-727776; AFCRL-71-0318) Avail: NTIS CSCL 17/9

Section 1 of the report summarizes Doppler signal processing techniques in the following areas: fast Fourier transform processing; pulse pair processing; doppler seperation using a Hilbert transformer. Section 2 of the report summarizes the following instrumentation developments: digital video integrator with range normalization; quadrature receiver with fast AGC response. Author (GRA)

N71-36562# Admiralty Surface Weapons Establishment, Portsmouth (England).
A THEORY FOR SIMPLE ASSOCIATIONS DURING TARGET TRACKING
A. L. C. Quigley Feb. 1971 18 p
(AD-727847; ASWE-TR-71-11; NSTIC-29817) Avail: NTIS CSCL 17/9

A process for calculating the probability of association of a measurement and a single forecast is derived for the simple case in which only one target out of m possibles is detected. The probability is shown to be a function of the probability of detection of each target and the number of targets in addition to the q-dimensional measured and forecast positions and their distributions. An example is given of the calculation of this probability for some simple cases. Author (GRA)

N71-36583 British Broadcasting Corp., Kingswood (England). Research Dept.
A THEORETICAL MODEL OF A COLOUR TELEVISION DISPLAY FOR THE ASSESSMENT OF RANDOM NOISE
E. W. Taylor 1971 11 p refs
(BBC-1971/27) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

A mathematical model of a colour television display is developed by means of which the subjective visibility of noise in the display may be computed from a knowledge of the noise-signal components at the three video-signal inputs to the display. Author

N71-36584 British Broadcasting Corp., Kingswood (England). Research Dept.
SIXTEEN mm FILM: IMAGE STEADINESS IN TELEVISION PRESENTATION. PART 1: THE MEASUREMENT OF UNSTEADINESS AND PREDICTION OF SUBJECTIVE IMPAIRMENT
D. T. Wright [1971] 18 p refs
(BBC-1971/28) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

Measurements of the overall steadiness of television film reproduction have shown that the error distribution is often not Gaussian. Since the frequency spectrum of the image displacement (regarding the latter as a function of time) can vary considerably for different films, account must be taken of the relative subjective visibilities of the different frequency components of the unsteadiness. The subjective tests outlined in this report establish the relative visibilities of these components. In addition, a method has been devised for predicting, from a picture-by-picture measurement of positional errors, the overall subjective impairment which the positional errors will cause when the film is reproduced on television. Author

N71-36585 British Broadcasting Corp., Kingswood (England).
SIMULTANEOUS SIGNALLING IN DIGITAL SOUND CIRCUITS: A FEASIBILITY STUDY
J. R. Chew 1971 7 p refs
(BBC-1971/26) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

A number of methods were investigated by which data for operational control of a broadcasting network may be conveyed as part of digital time division multiplex sound distribution signal. One method utilizes bits in the multiplex format which are otherwise unused; the remainder take advantage of redundancy in the sound signals, in the error checking signals or in the synchronizing signals, to convey additional data without correspondingly increasing the bit rate. Of these latter methods, two, based respectively on violation of the framing pattern and on occasional substitution of data bits for the least significant bits of the program signal, offer data rates which are generous for operational control applications and can be applied with simple instrumentation. Author

N71-36586 British Broadcasting Corp., Kingswood (England). Research Dept.
LONG DISTANCE TROPOSPHERIC PROPAGATION MEASUREMENTS AT UHF OVER MIXED LAND AND SEA PATHS CROSSING THE ENGLISH CHANNEL
C. P. Bell and S. J. Ashdown 1971 4 p refs
(Rept-1971/31) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The results of a series of long term tropospheric propagation measurements carried out at UHF over a number of mixed land and sea paths of lengths ranging from 195 to 330 km, are given. These measurements, which supplement the data available for frequency planning, are compared with values estimated by two prediction methods. This comparison, in association with a corresponding analysis of previously available results over such paths indicates that one of these methods tends to significantly overestimate field strengths. An amendment to this method is suggested which would reduce the mean error of prediction, but it would seem that significant improvements in prediction accuracy can only be achieved by taking account of the full transmission-path profile. Author

N71-36557 British Broadcasting Corp., Kingswood (England). Engineering Div.
A 16MM FILM: IMAGE STEADINESS IN TELEVISION PRESENTATION. PART 2: CAUSES OF UNSTEADINESS
J. A. Sanders Aug. 1971 14 p refs
(BBC-1971/29-Pt-2) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The steadiness of pictures derived from film and presented by television is very often unsatisfactory. The causes of this unsteadiness have been determined so that the contributions from each part of the system are known. Suggestions are made as to ways in which the present performance could be improved. Author

N71-36558 British Broadcasting Corp., Kingswood (England). Engineering Div.
AN EXPERIMENTAL QUADRATURE MODULATION SYSTEM FOR VIDEO SIGNALS
R. N. Robinson Aug. 1971 14 p refs
(BBC-1971/30) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

An experimental two-channel quadrature modulation system operating at VHF has been developed. This is used to illustrate the performance that may be expected of a practical system for transmission of wideband signals in the UHF or SHF bands. This method of modulation enables two signals to be transmitted at the same carrier frequency. Two carriers of identical frequency, but displaced in phase by 90 deg, are modulated separately and then added to form the quadrature-modulated signal. At the receiving terminal the two modulating signals are separated in synchronous detectors which are fed with reference carrier signals in phase quadrature. In order that the modulating signals can be separated completely, the reference carrier signals must be coherent with the quadrature-modulated signals. In the experimental system a pilot modulation signal (6 MHz) is transmitted to ensure the correct generation of the reference carrier signals. The theory and design of the system is considered, and measurements using independent video signals applied to the two modulators showed that crosstalk and distortion could be kept at a low level. The phase-locked oscillator used in the demodulator was capable of generating the reference carrier signals with an accuracy of 0.5 degrees over a range of input signal frequencies of 200 kHz. Author

N71-36559 Washington Univ., St. Louis, Mo.
ESTIMATION THEORY FOR A CLASS OF NONLINEAR RANDOM VECTOR CHANNELS
John Russell Grindon (Ph.D. Thesis) 1970 217 p refs
Avail: Univ. Microfilms Order No. 70-18948

Within the general problem of nonlinear, time-varying, random, with-memory, vector channel estimation, two classes of problems are studied; one in terms of noncausal estimation, and the other in terms of causal estimation. The noncausal problem model, having application to diversity communication, is stated briefly as follows. A scalar nonstationary Gaussian stochastic signal with known convariance function is transmitted over a random vector channel, which introduces a (with-memory) time-argument (scale shifting) disturbance, nonlinearly dependent upon a finite vector random variable and additive white Gaussian noise. The causal problem model, in terms of a multiple-sensor radar tracking problem, is stated briefly as follows. Consider p essentially omnidirectional radar (or sonar) sensors, p being greater than unity, and a number of transmitters from one through p. A single maneuvering radar (or sonar) target in space reflects or transponds some of the incident energy to the sensors. Dissert. Abstr.

N71-36560 Texas Univ., Austin.
OPTIMIZATION OF THE GEOMETRY OF DISTRIBUTED APERTURE RECEIVERS
Billy Boverie (Ph.D. Thesis) 1970 115 p
Avail: Univ. Microfilms Order No. 70-18207

An optimal spatial distribution of aperture of enhancing array reception is analytically developed. The optimization is carried out for three types of noise fields and for both spatially constrained and spatially unconstrained geometry of the array elements. The noise fields considered are those due to: (1) noise sources uniformly distributed in a volume around the array (isotropic noise), (2) noise sources uniformly distributed on an unbounded plane, and (3) highly directive noise fields such as a point noise source. The optimality criterion employed is minimization of the detection error probability for the array situation. For a phased array this is equivalent to maximization of the array detectability gain function which has the effect of maximizing the predetection signal-to-noise ratio. Situations under which such a criterion is valid are discussed and the associated time-optimal receiver structures for these situations are given. Dissert. Abstr.

N71-36561 State Univ. of New York at Buffalo.
AN ADAPTIVE NONPARAMETRIC APPROACH TO ESTIMATION AND SIGNAL PROCESSING
Lester Alan Gerhardt (Ph.D. Thesis) 1969 179 p
Avail: Univ. Microfilms Order No. 70-17329

The mathematical techniques of learning, decision, and optimization theory are combined in a study of an adaptive nonparametric approach to the problem of estimation. A deterministic algorithmic procedure which sequentially minimizes the mean square error is investigated. When used in conjunction with a linear adaptive network, this procedure yields successively better estimates of an output variable in terms of a set of input variables. It is shown that under certain conditions the nonparametric algorithm can be used to compute estimates of selected parameters of the governing density function. The basic procedure is extended to a least weighted squares algorithm. The application of the algorithmic procedure is studied as it relates to the following communications oriented problems: the hypothesis statistical decision problem, signal prediction, signal estimation, and signal to noise ratio maximization. Dissert. Abstr.

N71-36562 Tennessee Univ., Knoxville.
MICROWAVE AND RADIOFREQUENCY EXCITATION OF MERCURY ARCS
James David Durham (Ph.D. Thesis) 1969 116 p
Avail: Univ. Microfilms Order No. 70-17811

Three toroidal microwave frequency sources and one toroidal radiofrequency source were studied, using mercury vapor as the discharge medium. The first microwave source used the mercury discharge as a section of the center conductor of a coaxial transmission line. This source was not successful. The second microwave source made use of the mercury vapor as a lossy dielectric between the inner and outer conductors of a shorted transmission line. The intensities of seven mercury emission lines were measured photoelectrically as a function of mercury pressure, and a very slight intensity maximum was found for all of the lines at approximately 2.5 mm. The third microwave source consisted of placing a small vycor toroid directly into a terminated wave guide. Mercury pressure versus intensity measurements on the same seven lines again showed a very slight intensity maximum at 2.5 mm. Dissert. Abstr.

N71-36563 Pennsylvania State Univ., University Park.
AMPLITUDE AND PHASE SCINTILLATION OF HIGH FREQUENCY SATELLITE SIGNALS DUE TO IONOSPHERIC INHOMOGENEITIES
Murray Lawrence Rafsel (Ph.D. Thesis) 1969 190 p
Avail: Univ. Microfilms Order No. 70-19452

The diffraction of high frequency radio waves by inhomogeneities of electron density in the ionosphere with particular emphasis on the effects of the inhomogeneities on the phase of the received signals is discussed. Instrumentation is described which measures the amplitude and phase variations of the received signals at three stations spaced approximately 2.5 km apart on the ground. Analytic techniques are discussed which can yield measures of the ground pattern velocity, size, and

orientation from the measurements. To determine the relationship between the ground parameters and the form of the ionospheric disturbances causing them, the problem of the diffraction of a wave by a thin phase screen is investigated. Both a cosinusoidal phase variation, and a random variation of phase with position are considered. It is shown that close to the screen, the phase pattern will maintain the form of the variations in the screen more closely than will the amplitude pattern, especially when the phase variations introduced by the screen are large. Dissert. Abstr.

N71-36564 University of Southern Calif., Los Angeles.
STOCHASTIC OPTIMIZATION OF COHERENT COMMUNICATION SYSTEMS IN ADDITIVE WHITE GAUSSIAN CHANNELS
Seymour Moskowitz (Ph.D. Thesis) 1970 396 p
Avail: Univ. Microfilms Order No. 70-11378

A basic signal design problem in communication theory is that of determining the signal set which minimizes the probability of error, and further, of determining the dependence of the optimal signal set on the signal-to-noise ratio. This problem, also known as the signal selection problem, can be reduced to that of finding a set of M vectors in D-dimensional space which maximizes the detection probability functional. For equal energy constraints on the signals to be transmitted, the problem is further reduced to M unit vectors on a D-dimensional sphere. Since the concern is with maximizing a functional subject to a constrained signal set, known gradient techniques may be applied to obtain at least local maxima. The application of gradient techniques to obtain approximate solutions to the problem has been formulated and run on an IBM 360 computer. Convergence to local optimal points has been demonstrated. Dissert. Abstr.

N71-36565 Washington Univ., Seattle.
ON THE DETECTION OF SIGNALS IN REVERBERATION
Paul Henry Moose (Ph.D. Thesis) 1970 207 p
Avail: Univ. Microfilms Order No. 70-19643

The methods of statistical detection theory are applied to the problem of detecting signals with certain unknown parameters in reverberation noise. It is shown that the reverberation noise power is proportional to the transmitted signal energy and, consequently, that improvements in receiver performance cannot be made against reverberation, as they can against non-signal related noise, by increasing the transmitted energy. It is also shown how the receiver performance depends on the transmitted signal waveform. This dependence is introduced via the correlation function of the reverberation. The correlation function of reverberation is derived by assuming that the noise arises as the superposition of echoes resulting from the reflection of the transmitted sound from point scatterers distributed throughout the scattering region according to a Poisson law. The optimum detector for signals in reverberation is derived and compared to the conventional matched filter receiver. Dissert. Abstr.

N71-36566 Ohio State Univ., Columbus.
ANALYSIS AND MEASUREMENT OF A DIPOLE ANTENNA MOUNTED SYMMETRICALLY ON A CONDUCTING SPHERE OR CYLINDER
Leonard Lo-Ho Tsai (Ph.D. Thesis) 1970 233 p
Avail: Univ. Microfilms Order No. 70-19374

The problem of a cylindrical dipole antenna symmetrically mounted on either a conducting sphere or coaxial cylinder is analyzed both theoretically and experimentally. The theoretical approach is based on the Fourier Transform solution for thin wire antennas, equivalence and image principles, point matching, and numerical optimization. In the case of the dipole sphere, electrostatic imaging and variational considerations are used to determine the source and matching point locations. For the dipole cylinder, three gauges involving weighted integrals of the tangential electric fields are used to optimize the solution. For both modified dipole configurations, good agreements between measurement and theory are obtained for the input admittances, resonance properties, and radiation patterns. A method for computing both near and far fields of magnetic ring currents using numerical differentiation technique is also derived. Dissert. Abstr.

N71-36567 New York Univ., N.Y. School of Engineering and Science.
NONPARAMETRIC DETECTION TECHNIQUES USING SOME CLASSES OF LINEAR RANK STATISTICS
Stewart Cohen (Ph.D. Thesis) 1969 203 p
Avail: Univ. Microfilms Order No. 70-9769

Nonparametric detection procedures based on the class of two-sample Chernoff-Savage linear rank statistics are developed which are applicable in communication, radar and sonar problems. The performance of various forms of the three-sample detector and the standard two-sample detector are compared on the basis of large sample error probability for the important case of small signal-to-noise ratio. Due mainly to the invariant optimum detector parameters, the three-sample detection procedures result in improved performance over a wide range of signal-to-noise ratio and in a relatively unspecified environment where the statistics of the signal and noise and the a priori signal probability are unknown. Error bounds are also established. Dissert. Abstr.

N71-36568 New York Univ., N.Y. School of Engineering and Science.
SOME CONTRIBUTIONS TO NONPARAMETRIC COMMUNI-CATION THEORY: M-ARY DETECTION, CAPACITY OF RANK CHANNELS, DETECTION BASED ON M-INTERVAL PARTITIONING
Yau Chau Ching (Ph.D. Thesis) 1969 169 p
Avail: Univ. Microfilms Order No. 70-9768

Some nonparametric signal detection problems are considered using a new approach called nonparametric partitioning of the sample space, which results in detectors designed in two stages. First, the n-dimensional Euclidean sample space is separated into a finite number of regions, called nonparametric partitions, based only on a few general properties of the noise. Secondly, test statistics are defined as set functions of these nonparametric partitions, based on the properties of the signalling methods and the selected performance criteria. Using this new approach, three separate detection problems are considered. A new nonparametric partitioning, called m-interval partitioning, is proposed. Subject to certain restrictions, the resulting detectors are distribution-free. They have relatively high ARE when compared to the optimum detector for Gaussian noise. If the noise distribution is known, the most powerful m-interval detector is derived. Dissert. Abstr.

N71-36569 Purdue Univ., Lafayette, Ind.
SIGNAL PROCESSING WITH SAMPLED CORRELATIONS
Fred Russell Lawson, Jr. (Ph.D. Thesis) 1970 219 p
Avail: Univ. Microfilms Order No. 70-19686

Receiver structures employing sampled correlators are considered. The system is composed of an active source that generates a sample function of a random process, and a correlator receiver. Because of the active source, a noise free reference signal is available for use in the receiver. The other signal at the correlator input is assumed to be comprised of a back scattered component that is correlated with the reference signal plus Gaussian noise generated at the receiver. Emphasis in this study is on system operating conditions in which the noise component dominates the received channel. The study proceeds from consideration of particular correlating devices to systems that use a reference signal in conjunction with the received signal to form the output. Dissert. Abstr.

N71-36570 Carnegie-Mellon Univ., Pittsburgh, Pa.
DOPPLER MEASUREMENT USING STOCHASTIC APPROXIMATION

Roy Allen Westerberg (Ph.D. Thesis) 1970 201 p
Avail: Univ. Microfilms Order No. 70-19738

The Robbins-Monro stochastic approximation algorithm is investigated as a potential technique for estimating the Doppler frequency of a train of radar-echo pulses. This algorithm is attractive because it is computationally simple, allows real time processing of single pulses as they are received, and avoids the need for complex equipment such as banks of filters. A lower bound on mean-squared-error, based on the Cramer-Rao inequality, is derived. Knowledge of the prior distribution may be used to improve accuracy by biasing the estimates. By this approach, the resulting accuracy will depend on the particular bias used. The bound is independent of the bias. It serves to bound the estimation accuracy, measured by the average of the mean-squared-error. Furthermore, it provides a standard of comparison, since with the same prior knowledge no estimator can yield smaller error. Dissert. Abstr.

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics

N71-38571*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
S/360 TELOR3 PROGRAM DESCRIPTION TEST, EDIT, AND LIST AND ORB3A TAPE
Robert K. Schlessinger (Computer Sci. Corp.) Jul. 1971 213 p refs
(Contract NAS5-11790)
(NASA-TM-X-65692; X-552-71-283) Avail: NTIS CSCL 09B

The S/360 TELOR3 program which tests, edits, and lists the information on an ORB3A tape is documented. The documentation includes narrative descriptions (including flowcharts) of the main driver routine and the subroutines of the TELOR3 program, a user's guide, cross reference charts pertaining to the source program, and a compiled listing of the source program. Author

N71-38572*# TRW Systems Group, Redondo Beach, Calif. Propulsion Systems Section.
TRANSIENT ANALYSIS ATTITUDE CONTROL PROPULSION SYSTEMS COMPUTER PROGRAM DOCUMENTATION AND USER'S MANUAL
T. J. Walsh and R. W. Pringle Jun. 1971 142 p ref
(Contract NAS9-8166)
(NASA-CR-115182; TRW-17618-H180-R0-00) Avail: NTIS CSCL 09B

A computer program for the transient operation of auxiliary control propulsion systems (ACPS) is presented. All components that are normally associated with ACPS have been modeled and include fluid lines, valves, line junctions, regulators, orifices, combustors, manifolds, turbopumps, accumulators, pressure regulators, and tanks. The components can be connected together in an arbitrary manner to simulate a variety of ACPS configurations. The theory and mathematical derivation for the computer program is described. Author

N71-38573*# TRW Systems Group, Redondo Beach, Calif. Propulsion Systems Section.
STEADY-STATE ATTITUDE CONTROL PROPULSION SYSTEMS COMPUTER PROGRAM DOCUMENTATION AND USER'S MANUAL, VOLUME 1
P. F. Thompson and R. C. Turley Jun. 1971 89 p refs
(Contract NAS9-8166)
(NASA-CR-115184; TRW-17618-H181-R0-00) Avail: NTIS CSCL 09B

The steady state attitude control propulsion system (SSACPS) was developed with the capability to simulate operation of ACPS components connected in a large variety of configurations. The components are connected within the program by the user, using data required to define initial and operating conditions. The system model uses hydrogen and oxygen properties from detailed NBS property subroutines. The data are input through the numerical input subroutine TRWLOD and the system equations are solved by the nonlinear equation solver, TRW BEGS. The constraint equations for each component set and the state variables are selected by the user. This allows a great deal of flexibility in solving for either fluid state points or component dimensions. Author

N71-38574*# TRW Systems Group, Redondo Beach, Calif. Propulsion Systems Section.
STEADY-STATE ATTITUDE CONTROL PROPULSION SYSTEMS COMPUTER PROGRAM DOCUMENTATION AND USER'S MANUAL, VOLUME 2
P. F. Thompson and R. C. Turley Jun. 1971 277 p refs
(Contract NAS9-8166)
(NASA-CR-115185; TRW-17618-H204-R0-00) Avail: NTIS CSCL 09B

A listing of the Steady-State Attitude Control Propulsion System Computer Program (SSACPS) is presented. The SSACPS was developed as a general computer simulation model capable of modeling a large variety of attitude control propulsion systems (ACPS). The SSACPS was developed with the capability to simulate operation of ACPS components connected in a large variety of configurations. The components are connected within the program by the user using input data to define initial and operating conditions. The component models consist of gas generators, monopropellant and bipropellant combustors; lines including abiabatic, isothermal, and heat transfer with friction-liquid/gas; heat exchangers; junctions; regulators; pressure boundaries; and liquid and gas valves. Author

N71-38575# United Kingdom Atomic Energy Authority, Harwell (England).
DIODE: A COMPUTER PROGRAM FOR THE COMPREHENSIVE EVALUATION OF GAMMA SPECTRA
R. J. Bullock and N. R. Large Apr. 1971 31 p
(AERE-R-6748) Avail: AEC Depository Libraries

DIODE is a versatile computer program for the processing of gamma spectra obtained from Ge(Li) detectors. It will accept data from several different types of multichannel analyzers, and presents options ranging from a simple print-out of the spectrum to a complete analysis. The constituents can be identified and their activities determined by comparison with a library of gamma ray energies and intensities. Graphical output can also be obtained if desired. DIODE is written in FORTRAN 4 for an IBM 360/75 computer. Author (NSA)

N71-38576*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PLOTTER ROUTINES FOR THE IBM 1800 COMPUTER
T. P. Carleton Sep. 1971 54 p refs
(NASA-TM-X-65708; X-692-71-378) Avail: NTIS CSCL 09B

Subroutines were written to facilitate use of the IBM 1627 plotter associated with an IBM 1800 computer. They were implemented under the Multiprogramming Executive Operating Systems (MPX) and all information pertains to the MPX versions. The programs are designed to permit graphic presentation of data with a minimum of programming effort. Most standard types of plots can be produced by calling one of the programs. Options are included for linear or logarithmic tickmarks or grids, multicolor plotting, the tracing of several curves or sets of data points on the same base, and histogram plotting. The subroutines also provide the basic tools for designing special purpose plots. Routines for controlling pen movement in terms of inches or user defined units, writing alphabetic or numeric text, plotting special symbols, changing the scale of plots, and isometric presentation of three dimensional data are included. Author

N71-36577# Oak Ridge National Lab., Tenn.
SPECTRAN: A COMPUTER SYSTEM TO ANALYZE HIGH RESOLUTION SPECTRUM. VOLUME 1 - USER'S MANUAL
A. F. Joseph Jan. 1971 20 p ref
(Contract W-7405-eng-26)
(ORNL-4606) Avail: NTIS

The SPECTRAN system is a generalized spectrum analysis code composed of various independent modules which contain algorithms and subroutines to perform certain requested tasks. While there are many programs to analyze spectra, this program's advantage is that there are many options available and that their respective formats pose no problem to a potential user. Also, if certain special options are not available, the user has the ability to use his own subroutine with the system, and knowing the format of the common areas, he is able to perform manipulation on his data or on the results generated by the system. Author

N71-36578# Sandia Labs., Albuquerque, N.Mex.
COMPUTER-BASED DISPLAY OF NONDESTRUCTIVE EVALUATION DATA
B. Stiefeld May 1971 28 p refs Sponsored by AEC
(SC-DR-710222) Avail: NTIS

Techniques developed to reduce large amounts of data acquired by automated or semiautomated digital acquisition systems are discussed. These techniques include: (1) automatic generation of three-dimensional plots of characteristics over large surface areas, (2) contour plotting of significant gradients in data, (3) use of color to supplement digital enhancement techniques, and (4) multisectioned plots of large bodies to show internal flaw areas. Author

N71-36579# Sandia Labs., Albuquerque, N.Mex.
PANS: A COMPUTER PROGRAM FOR THE ANALYSIS OF SPACE FRAMEWORKS
Walter B. Murlin Apr. 1971 85 p refs Sponsored by AEC
(SC-RR-70-742) Avail: NTIS

The piping systems of refineries and power plants were considered as complex space frameworks, often multiply branched, and highly indeterminate. They are subject to drastic changes of temperature, pressure, and external loads. The program was used in the analysis of thermal stresses in microcircuit leads. Microcircuits, like piping systems, can be an arbitrary assemblage of straight and curved members. The program was also used for the analysis of curved springs.
Author

N71-36580# New York Univ., N.Y. AEC Computing and Applied Mathematics Center.
A 16 CHANNEL MEDIUM SPEED MULTIPLEXER
Vincent T. Prestianni May 1971 109 p
(Contract AT(30-1)-1480)
(NYO-1480-171) Avail: NTIS

A medium speed multiplexer system that interfaces 16 synchronous serial channels to a Honeywell 16-bit series computer is described. The system permits simultaneous communication between the Control Data 6600 computer and any 16 sites accessible by telephone or private line. The multiplexer handles all remote batch entry of the CDC-6600.
Author

N71-36581# Technische Hochschule Munchen (West Germany). Fakultaet fuer Allgemeine Wissenschaften.
OPERATOR IDENTIFICATION IN ALGOL 68 [OPERATOR-IDENTIFIZIERUNG IN ALGOL 68]
Hans Woessner (Ph.D. Thesis) 1970 81 p refs In GERMAN
Avail: NTIS

Efficient algorithms for operator identification in an ALGOL 68 translator are developed and used to declare freely selected indicating symbols as single or binary operators. Eligible are all operators suitable for coercion into the parametric mode.
Transl. by G.G.

N71-36582# Compagnie Francaise Thomson Houston-Hotchkiss Brandt, Paris. Lab. Central de Recherches.
INTEGRATED MAGNETIC MASS STORAGE WITH HIGH CAPACITY: SUMMARY OF RESULTS OBTAINED DURING 1970 [MEMOIRES MAGNETIQUES DE MASSE SOUS FORME INTEGREE A GRANDE CAPACITE: RECAPITULATION DES RESULTATS OBTENUS AU COURS DE L'ANNEE 1970]
14 Dec. 1970 5 p In FRENCH
(Rept-1413) Avail: NTIS

Work carried out during 1970 on the development of mass storage devices with a concentration of 3300 bits/square centimeter with a capacity of 150,000 bits is discussed. ESRO

N71-36583# Compagnie Francaise Thomson Houston-Hotchkiss Brandt, Paris.
WAFER MEMORY: INCREASE OF SIZE AND STORAGE CAPACITY OF FERRITE WAFERED MEMORIES Final Report [MEMOIRE A GAUFRE: ACCROISSEMENT DE LA DENSITE ET DE LA TAILLE DES MEMOIRES A GAUFRE DE FERRITE RAPPORT FINAL]
P. Meunier May 1970 12 p In FRENCH
Avail: NTIS

The development of ferrite wafered computer memories on copper substrate is reported, discussing size and storage capacity. ESRO

N71-36584# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
DEVELOPMENT OF BEHAVIORAL SCIENCE PROGRAMMING LANGUAGE Final Report, Aug. 1969 - Jun. 1970
Sheldon Baron, William H. Levison, Raymond S. Nickerson, William R. Sutherland, and Elaine L. Thomas Orlando, Fla. Naval Training Device Center Feb. 1971 63 p refs
(Contract N61339-70-C-0046)
(AD-726432; BBN-1979; NAVTRADEVCEN-70-C-0046-1) Avail: NTIS CSCL 09/2

Design criteria and an implementation plan are specified for a Behavioral Science Programming Language BSPL to be used for programming experiments on the computer-driven, high-performance aircraft simulation facility at Naval Device Training Center (NDTC). The BSPL was conceptualized with the following goals in mind: (a) the language should take full advantage of the existing hardware and software facilities; (b) it should be rich enough in structure to allow the programming of meaningful experiments, yet simple enough to be readily learned by the non-programmer; (c) it should be usable by individuals who do not have intimate knowledge of the simulation program; (d) it should be incrementally implementable; and (e) it should be capable of graceful expansion and elaboration. The report begins with a description of the present facility, a conceptualization of a prototype experiment, and the implication of these factors for the design of the BSPL. A proposed design is then presented along with an implementation plan. The implementation plan partitions the development of the language in such a way that incremental improvements in the facility can be realized as the plan is being carried out. A formal description of the language and a sample program are included as appendices.
Author (GRA)

N71-36585# Compagnie Francaise Thomson-Houston, Bagneux (France).
SIANA: AN ANALOG SIMULATION PROGRAM [SIANA: PROGRAMME DE SIMULATION DE SYSTEME ANALOGIQUE]
Oct. 1970 47 p In FRENCH
(DRS/9/079/TS) Avail: NTIS

A FORTRAN computer program is described which gives the simulation of movement as a function of time represented by a set of first order differential equations. A subroutine provides for plotting the curve. ESRO

N71-36586# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.
DETERMINING OPTIMAL GROWTH PATHS IN LOGISTICS OPERATIONS
V. Srinivasan and G. L. Thompson Apr. 1971 41 p refs
(Contract N00014-67-A-0314-0007)
(AD-726509; RR-240) Avail: NTIS CSCL 12/2

The paper considers a logistics system modeled as a transportation problem with a linear cost structure and lower bounds on supply from each origin and to each destination. An algorithm is provided for obtaining the growth path of such a system, i.e., determining the optimum shipment patterns and supply levels from origins and to destinations, when the total volume handled in the system is increased. Extensions of the procedure for the case when the costs of supplying are convex and piecewise linear and for solving transportation problems that are not in standard form are discussed. A procedure is provided for determining optimal plant capacities when the market requirements have prespecified growth rates. A goal programming growth model where the minimum requirements are treated as goals rather than as absolute requirements is also formulated. Author

N71-36587# Utah Univ., Salt Lake City.
GRAPHICAL MAN/MACHINE COMMUNICATIONS Final Technical Report, 1 Dec. 1969 - 30 Jun. 1970
David C. Evans Griffiss AFB, New York RADC May 1971 48 p refs
(Contract AF 30(602)-4277; ARPA Order 829)
(AD-726623; RADC-TR-71-104) Avail: NTIS CSCL 09/2

The document includes a summary of research activities and facilities at the University of Utah under the contract. Report abstracts convey important research milestones attained during this period by each of the four major research activities: computer graphics techniques; computing systems; digital waveform processing; applications. Author (GRA)

N71-36588# RAND Corp., Santa Monica, Calif.
COMPUTER TECHNIQUES FOR PSEUDOCOLOR IMAGE ENHANCEMENT
Jeannine V. Lamar Jun. 1971 42 p refs Original contains color illustrations
(Grant HE-12546-03)
(R-787-NIH) Avail: NTIS

Techniques have been developed for creating computer-generated separations for pseudocolor transformations. A halftone process was chosen in which a picture was divided into many small areas and pseudorandom patterns plotted in each. Twenty-one patterns were designed, based on an elemental area of a 20 x 20-raster square, to produce 35mm microfilm frames containing plots of the patterns; their densities were established by densitometer reading. The examples described are for creating pseudocolor transformations based on the two-separation process, but the techniques are applicable for processes requiring any number of separations. A Fortran program was written to create a 21-step gray scale, with each step a rectangle constructed from the patterns. Two separations of the gray scale were generated, and a color scale was produced using the separations as the red and blue records in the two-separation process. A pseudocolor transformation of an image created from digital data was also accomplished. Author

N71-36589*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
A FORTRAN 5 PROGRAM FOR PREDICTING THE DYNAMIC RESPONSE OF THE APOLLO COMMAND MODULE TO EARTH IMPACT
William E. Thomas, Jr. Washington Oct. 1971 158 p
(NASA-TN-D-6539; MSC-S-265) Avail: NTIS CSCL 09B

A FORTRAN V digital-computer program, capable of determining the nonlinear motion of two six-degree-of-freedom rigid bodies connected by shock struts and subjected to ground impact, is presented in this report. A sample problem is included to provide a correlation between computer results and actual test results. Author

N71-36590# National Bureau of Standards, Washington, D.C. Information Processing Technology Div.
CALIBRATION OF NBS SECONDARY STANDARD MAGNETIC TAPE (COMPUTER AMPLITUDE REFERENCE) SRM 3200 USING THE REFERENCE TAPE AMPLITUDE MEASUREMENT PROCESS A MODEL 2
Sidney B. Geller Jun. 1971 57 p
(NBS-SP-260-29) Avail: SOD $.60

The design, operation and calibration of the signal amplitude measuring system that is used for calibrating unrecorded Secondary Standard Magnetic Tapes SRM 3200 is described. The signal level calibration is made with respect to a reference signal level derived from the Master Standard Magnetic Tape (Computer Amplitude Reference). The techniques for measuring and recording the data that accompany each Secondary Standard Magnetic Tape in the form of strip chart recordings and saturation curves are described. Author

N71-36591 Stanford Univ., Calif.
MAN/COMPUTER AUGMENTATION SYSTEMS FOR QUALITATIVE PLANNING
David Alexander Evans (Ph.D. Thesis) 1970 504 p
Avail: Univ. Microfilms Order No. 70-18401

The methodology supports the procedural realm of a planner's work, pervading most of his intellectual activity. The viewpoint is that of augmentation systems, in which tools, techniques, procedures, and skills are considered to be interacting symbiotically with man, as an integrated system, to extend man's intellectual capabilities. Research is concerned with interactive man/computer augmentation systems (IMCAS) in two primary roles: for support of an individual's understanding to his own information, and for support of a team member's participation in the deliberations of the team. Investigation and design focussed on specific IMCAS, and on the development of an overall framework to relate these systems to planners' needs: ENVIRON, a simple-minded IMCAS, designed to aid an individual in the very early stages of concept formation, and a dialogue support system (DSS), to facilitate creative interactions among members of a team of planners. Dissert. Abstr.

N71-36592 Texas Univ., Austin.
SENSITIVITY ANALYSIS OF KALMAN ESTIMATORS
Malcolm Richard Railey (Ph.D. Thesis) 1970 284 p
Avail: Univ. Microfilms Order No. 70-18279

The effects of modeling errors on the performance of Kalman estimators are investigated. Both continuous data and sampled data Kalman estimators were studied for filtering, prediction, and smoothing (interpolation). Several sources of modeling errors were considered both from a theoretical and computer simulation standpoint. In addition, both deterministic and random modeling errors were studied. The results are useful in assessing a priori (prior to designing) the expected degradation in performance of the Kalman estimators due to modeling errors. Dissert. Abstr.

N71-36639# Plessey Co., Ltd., Ilford (England).
TECHNOLOGY FOR SOLID STATE STORAGE
J. D. Wilcox *In* Polytech. of N. London Microcircuits and Their Appl. Jun. 1971 2 p refs (See N71-36625 23-10)
Avail: NTIS

N71-36640# Fairchild Semiconductor, Ltd., New Barnet (England).
SEMICONDUCTOR MEMORY SYSTEMS
S. Ahmed *In* Polytech. of N. London Microcircuits and Their Appl. Jun. 1971 24 p refs (See N71-36625 23-10)
Avail: NTIS

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N71-36593*# Varian Associates, Beverly, Mass. Eastern Tube Div.
EXPERIMENTAL VERIFICATION OF THE DESIGN OF AN AXIAL INJECTION CROSSED-FIELD AMPLIFIER Final Report
H. L. McDowell 15 Jun. 1970 162 p refs
(Contract NAS3-11528)
(NASA-CR-72976; V/ETD-54008-F) Avail: NTIS CSCL 09A

The design of an S-band axial injection crossed field amplifier capable of 5 kw CW and 20 db of gain is described. The RF dynamic range of the CFA is enhanced by proper design of a reflector electrode at the sides of the interaction space. An experimental vehicle built to verify the design was not successful because of aberrations in the beam optics at the circumferential end of the gun. Design studies show that this is a correctable defect. Author

N71-36594*# Cornell Univ., Ithaca, N.Y.
RESEARCH INTO ADVANCED CONCEPTS OF MICROWAVE POWER AMPLIFICATION AND GENERATION UTILIZING LINEAR BEAM DEVICES Semiannual Status Report
P. R. McIsaac Jun. 1971 24 p refs
(Grant NGL-33-010-047)
(NASA-CR-121294) Avail: NTIS CSCL 20G

Theoretical results of some aspects of the interaction between a drifting stream of electrons with transverse cyclotron motions and an electromagnetic field are summarized. Particular emphasis is given to the possible generation and amplification of millimeter waves. A discussion of large signal effects in cyclotron resonance oscillators is included with special attention given to the power saturation mechanism. Author

N71-36595*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF COMPUTER-ACQUIRED PERFORMANCE DATA FROM SEVERAL FIXED SPACED PLANAR DIODES
E. J. Manista, A. L. Smith, and R. B. Lancashire 1971 10 p refs Presented at the Thermionic Conversion Specialists Conf., San Diego, Calif., 4-6 Oct. 1971
(NASA-TM-X-67935; E-6611) Avail: NTIS CSCL 09A

Performance data are compared for thermionic diodes with various tungsten or rhenium emitters and niobium or molybdenum collectors. The planar converters have guard-ringed collectors and a fixed space of 10 mils (0.254 mm). The data were acquired using a computer. The parameters are the temperatures of the emitter, collector, and the cesium reservoir. The diodes were tested at increments between 1600 and 2000 K for the emitters, 750 and 1100 K for the collectors, and 520 and 650 K for the reservoirs. An average of 450 individual current voltage curves were obtained for each diode. Author

N71-36596*# Washington Univ., St. Louis, Mo.
PROGRAM ON APPLICATION OF COMMUNICATIONS SATELLITES TO EDUCATIONAL DEVELOPMENT. WIDEBAND CW MICROWAVE AMPLIFICATION USING GUNN EFFECT DEVICES
Amadou Sene and Fred N. Rosenbaum May 1971 103 p refs
(Grant NGL-26-008-054)
(NASA-CR-122947; Rept-T-71/3) Avail: NTIS CSCL 09E

The Gunn Effect has been used mainly for oscillator applications. Recently, the negative resistance properties of the Gunn diode have been used in reflection-type amplifiers. All the published work has been done in coaxial and microstrip circuits. This work extends the applications to waveguide circuitry. Broadband gains exceeding 10 dB over an IGHz bandwidth have been obtained. An equivalent circuit for the amplifier is proposed. Using experimental data on the phase and magnitude of the reflection coefficient and the equivalent circuit, the impedance of the diode is calculated. It is found that the equivalent series resistance is constant over a 1.8 GHz bandwidth at -30 ohms at 6.5 volts bias, and at -40 ohms at 7.0 volts over a 1.2 GHz band. Gain simulation on computer indicates that a series model for the diode gives good agreement with experimental data. Author

N71-36597# Bendix Corp., Kansas City, Mo.
HIGH TEMPERATURE FLAT CABLES Quarterly Report
J. J. Moeskowski, M. D. Mitchell, and W. W. Hilkar Nov. 1970 46 p refs
(Contract AT(29-1)-613)
(BDX-613-161; QR-FY-70-4) Avail: NTIS

The process for fabricating the ER-249 high temperature flat cable is discussed. Specific design goals were defined to characterize an assembly with a maximum loop inductance of 10 nanohenries and a dielectric strength, before and after solder dip exposure, of 15 kv dc. The ER-249 cable must also be capable of withstanding solder dip exposures in excess of 600 F and a high energy current pulse applied by a 10 kv source during solder dip. Meeting these specific goals has required studies of the tools, processing equipment, and materials used to fabricate the cables. The principal areas considered were: (1) addition of a postcure to the lamination process, selection of an appropriate cable configuration; (2) introduction of a high energy pulse voltage test during solder dip exposure, and (3) refinement of the base process for manufacture of the cable. Author (NSA)

N71-36598# Aeronautical Research Labs., Melbourne (Australia).
THE EDGE EFFECT IN EDDY CURRENT TESTING
I. G. Scott Feb. 1971 30 p refs
(ARL/MET-note-73) Avail: NTIS

The unexpectedly large changes in measured coil impedance which occur as the center line of the coil crosses the edge of the specimen were studied. The effect appears to be confined to coil configurations in which the energizing coil is larger than the detecting coil. The effect is strongly frequency dependent. Author

N71-36599# Compagnie Francaise Thomson Houston-Hotchkiss Brandt, Paris. Lab. Central de Recherches.
STUDY OF MICROWAVE PASSIVE COMPOSITE RESONATORS Final Report [ETUDE DE RESONATEURS PASSIFS COMPOSITES EN HYPERFREQUENCES RAPPORT FINAL]
E. Dieulessaint, D. Gouvernelle, and D. Cheuvin [1970] 60 p refs In FRENCH Sponsored by Delegation a la Rech. Sci. et Tech.
Avail: NTIS

The design of a quartz resonator in the 200 to 1000 megahertz band excited by a thin film piezoelectric transducer on the fundamental mode is described. Theoretical aspects and some technological problems are discussed. The system behaves as three intercoupled resonators having different Q factors. The influence of the film thickness is analyzed. ESRO

N71-36600# Compagnie Francaise Thomson Houston-Hotchkiss Brandt, Paris. Lab. Central de Recherches.
ELECTROACOUSTIC DELAY LINE BETWEEN 1200 AND 1800 MHz Final Report [LIGNE A RETARD ELECTRO-ACOUSTIQUE BANDE 1200 A 1800 MHZ RAPPORT FINAL]
P. Defranould [1970] 21 p In FRENCH Sponsored by Serv.

Tech. de Construct. Aeronavales
Avail: NTIS

A broadband delay time was developed for space applications. It is based on a zinc oxide/alumina couple with an interjacent electrode. The design is discussed, and experimental results are analyzed. ESRO

N71-36601# Compagnie Francaise Thomson Houston-Hotchkiss Brandt, Paris. Lab. Central de Recherches.
DEVELOPMENT OF A TRANSVERSAL SOUND WAVE DELAY LINE WITH COMPENSATED LOSSES Final Report [REALISATION D'UNE LIGNE A RETARD A ONDES ACOUSTIQUES TRANSVERSALES ET A PERTES COMPENSEES RAPPORT FINAL]
P. Defranould [1970] 72 p refs In FRENCH
Avail: NTIS

A device was developed to delay pulses by converting electromagnetic waves into transverse elastic waves by means of piezoelectrical thin film transducers. Insertion losses are compensated for by an electroacoustic amplifier. The theoretical aspects and results obtained with the device are discussed. ESRO

N71-36602# National Aviation Facilities Experimental Center, Atlantic City, N.J.
TEST AND EVALUATION OF A VOR SOLID STATE MODULATION ELIMINATOR REPLACEMENT Final Report, Mar. 1969 - Aug. 1971
Barry S. Brayer Sep. 1971 24 p
(FAA-NA-71-28) Avail: NTIS

The results of tests conducted on a breadboard solid state RF amplifier unit designed to replace the power divider and modulation eliminator in a conventional VOR installation are reported. The data obtained from tests on this equipment will be used to provide the basis for specifications of a prototype model. Author

N71-36603# Joint Publications Research Service, Washington, D.C.
RESONANCE METHOD OF MEASURING WAVEGUIDE IRREGULARITIES THAT CAUSE SMALL REFLECTIONS
D. I. Voskresenskiy 21 Sep. 1971 21 p refs Transl. into ENGLISH from Tr., Mosk. Aviats. Inst., Vopr. Radiotekhn. i Elektron. Sverkhvysokikh Chastot (Moscow), v. 98, 1958 p 64-82
(JPRS-54096) Avail: NTIS

The resonance method is considered for measuring and experimentally investigating the equivalent circuits of the joints between straight waveguides and uniformly bent guides. The experimental and computed results obtained from theoretical formulas previously published are compared. The resonance method of measuring small coefficients of reflection is also discussed for investigating other forms of irregularity in waveguides and feeder lines. Author

N71-36604# Joint Publications Research Service, Washington, D.C.
STUDIES ON FM RANGE FINDERS AND REFLEX KLYSTRON OSCILLATORS
21 Sep. 1971 32 p refs Transl. into ENGLISH from Nekotorye Vopr. Impulsnoy Tekhn. i Tekhn. SVCH., Tr. Mosk. Aviats. Inst. (Moscow), v. 83, 1957 p 3-29
(JPRS-54097) Avail: NTIS

CONTENTS:
1. FOREWORD A. G. Saybel
2. THEORY OF FREQUENCY-MODULATED ALTIMETERS A. G. Saybel p 3-25 refs (See N71-36605 23-09)
3. AN EXPERIMENTAL STUDY OF THE OPERATION OF A REFLEX KYLSTRON OPERATING IN THE THREE-CENTIMETER BAND IN THE INCREASED POWER MODE P. A. Bekulev p 26-31 ref (See N71-36606 23-09)

N71-36605# Joint Publications Research Service, Washington, D.C.
THEORY OF FREQUENCY-MODULATED ALTIMETERS
A. G. Saybel *In its* Studies on FM Range Finders and Reflex Klystron Oscillators 21 Sep. 1971 p 3-25 refs (See N71-36604 23-09)
Avail: NTIS

The theory of electronic frequency-modulated altimeters is reviewed, and the peculiarities of their operation in the measurement of low altitudes are examined. An analysis is given of the dependence of electronic altimeter errors on various factors, and the effect of parasitic amplitude modulation on altimeter operation is considered. D.L.G.

N71-36606# Joint Publications Research Service, Washington, D.C.
AN EXPERIMENTAL STUDY OF THE OPERATION OF A REFLEX KLYSTRON OPERATING IN THE THREE-CENTIMETER BAND IN THE INCREASED POWER MODE
P. A. Bekulev *In its* Studies on FM Range Finders and Reflex Klystron Oscillators 21 Sep. 1971 p 26-31 ref (See N71-36604 23-09)
Avail: NTIS

The operational characteristics of low-powered klystron oscillators in the three-centimeter range and in the pulse mode were investigated. The experiments conducted and the equipment employed are described. A principle aim of the investigation was to clarify the question of the possibility of using an ordinary reflex klystron of the heterodyne type for generating a pulse power above 2 watts in wavelengths of the order of 3.2 cm. The experimental results indicate that ordinary heterodyne klystrons of 3.2 cm wavelength range can be used to obtain pulse power of up to 3 to 5 watts per pulse. D.L.G.

N71-36607# Joint Publications Research Service, Washington, D.C.
UNIFORMLY BENT RECTANGULAR WAVEGUIDES
D. I. Voskresenskiy 20 Sep. 1971 44 p refs Transl. into ENGLISH from Tr. Vopr. Radiotekhniki Sverkhvysokikh Chastot (Moscow), v. 73, 1957 p 5-44
(JPRS-54095) Avail: NTIS

Problems in the theory of regular uniformly bent waveguides with rectangular cross sections for any bending radius were examined, and the results of the experimental verification of the basic tenets of the theory of such waveguides are presented. Author

N71-36608# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HIGH-POWER ELECTRONICS, SELECTED ARTICLES
P. L. Vainshtein et al 26 Jan. 1971 289 p refs Transl. into ENGLISH from Electron. Bolshikh Moshchnostei (USSR), no. 4, 1965 p 189, 206-242
(AD-726796; FTD-HC-23-262-70) Avail: NTIS CSCL 09/1

Contents: Mode converters from H into E waves; The experimental study of the converter; The geometric optics of three-dimensional oscillations in open resonators; Beam fluxes in a triaxial ellipsoid; Diffraction in open resonators with confocal mirrors; Excitation of electromagnetic oscillations in open resonators; A test body in an open resonator; Microtron of continuous operation; Absolute measurements of the high frequency field in a resonator; Electron motion in a double-series nigotron. GRA

N71-36609# Rensselaer Research Corp., Troy, N.Y. Electronic Systems Dept.
BULK SEMICONDUCTION LIMITERS Quarterly Progress Report, 1 Nov. 1970 - 31 Jan. 1971
Albert L. Armstrong, Paul E. Bakeman, Jr., and Wayne C. Taft Fort Monmouth, N. J. ECOM Jul. 1971 35 p
(Contract DAAB07-70-C-0195)
(AD-726942; ECOM-0195-3; QPR-3) Avail: NTIS CSCL 09/1

The effort stresses the realization of performance goals for solid state microwave limiters as well as the measurement of their noise emission characteristics. The successful fabrication and testing of checkerboard limiters was achieved. Duplexer recovery time measurements showed that these limiters exceed the performance recovery time goal of 2 microseconds to 3 dB loss after a 5 kilowatt pulse. Gated noise measurements and system sensitivity measurements were made on slow recovery phosphorus diffused limiters. The results of these measurements indicate that performance is degraded by less than 1 dB by recovery period noise. Other discussions presented include improvements in fabrication and high power performance. Results of cascaded limiter tests are also included in the report.
Author (GRA)

N71-36610# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.
LARGE TIME-BANDWIDTH PRODUCT MICROWAVE DELAY LINE Final Report, 1 Jul. - 31 Dec. 1970
Henry M. Gerard, Michael T. Wank, Rolf D. Weglein, and Edward D. Wolf Fort Monmouth, N. J. Jun. 1971 94 p refs
(Contract DAAB07-69-C-0365)
(AD-726944; ECOM-0365-F) Avail: NTIS CSCL 09/1

The objective of the program is to develop a large time-bandwidth product tapped delay line employing acoustic surface waves at microwave frequencies. The essential components of this device include tuned interdigital transducers, surface wave amplifiers and air gap couplers all operating at a center frequency of 1.0 GHz. The report describes achievements in each development area and includes measured data for a five tap 30 microsec long surface wave delay line. Author (GRA)

N71-36611*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN APPROXIMATE SOLUTION FOR THE RADAR ECHO PULSE RESPONSE FOR PLANETARY RADAR ALTIMETERS
W. Thomas Bundick Washington Oct. 1971 28 p refs
(NASA-TN-D-6434; L-7895) Avail: NTIS CSCL 17I

An approximate solution for the radar echo pulse response has been developed to compute the expected return pulse amplitude and shape for planetary radar altimeters. Results obtained with the solution show excellent agreement with results obtained by numerical integration; in addition, this present solution requires much less computer time. The new solution is applicable over a wider range of altitudes and pulse widths than the solution previously presented. The present solution is also more accurate at low altitudes and for long pulse widths.
Author

N71-36612# Radio Corp. of America, Princeton, N.J. Electro-Optics Lab.
INVESTIGATION OF SOLID STATE COLD CATHODES Final Report, 16 Mar. 1970 - 16 Mar. 1971
Elliott S. Kohn 27 May 1971 73 p refs
(Contract F19628-70-C-0235)
(AD-726644; AFCRL-71-0331) Avail: NTIS CSCL 09/1

Cold cathode emission was obtained from forward biased silicon p-n junctions whose p-surfaces were activated to a state of negative electron affinity. In operation, electrons injected into the p-layer diffuse to the surface where they are emitted into vacuum. A Si:SiO2 structure has been developed to overcome the problems associated with current crowding, and, with this structure, efficiencies (ratio of emitted current to bias current) as high as 10% have been observed. Emitted current densities as large as 225 amps/sq cm and currents as large as 7 mA have been drawn under pulsed conditions while continuous current densities of 1 amp/sq cm and currents of tens of microamperes have been drawn for many hours. The electrical characteristics exhibited space-charge-limited and emission-limited regimes as well as Schottky effect. Calculations made of the current density profiles across the junctions indicate that practical levels of operation can be achieved with reasonably uniform emitted current profiles. The silicon cold cathode may have advantages in applications such as vidicons where some aspects of performance are presently limited by the thermionic cathode.
Author (GRA)

N71-36613# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE LNSW 11 THYRISTOR HIGH VOLTAGE SWITCH GEAR
L. Lojak 19 Mar. 1971 11 p ref Transl. into ENGLISH from Elektrie (East Germany), v. 24, no. 2, 1970 p 38-39
(AD-727439; FTD-HT-23-104-71) Avail: NTIS CSCL 09/1

The LNSW 2 thyristor high voltage switch gear developed by VEB LEW Hans Beimler permits continuous voltage adjustment and is described. The most important properties of the new control, which was submitted to a service test in connection with an electronic switch gear motor control, are described by means of oscillograms.
GRA

N71-36614 National Lending Library for Science and Technology, Boston Spa (England).
THE USE OF THYRISTORS TO PRODUCE A MEDIUM FREQUENCY CURRENT
P. Guesne 20 Apr. 1971 15 p Transl. into ENGLISH from proceedings of 8th Intern. Congr. on Electro-heat, Brighton, Engl., 13-18 May 1968
(NLL-Risley-Trans-2128-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The advantages and use of electrode regulators equipped with thyristors for arc furnaces is reviewed. The use of prototype inverters equipped with thyristors for medium frequency induction heating is discussed in detail.
J.G.M.

N71-36615 National Lending Library for Science and Technology, Boston Spa (England).
CALCULATION AND MEASUREMENT OF STRAY LOSSES IN INDUCTION MOTORS
M. Pasdeloup [1971] 6 p refs Transl. into ENGLISH of N.C.G.E, Nancy, report
(NLL-M-20559-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The calculation of the temperature rise of large induction motors, especially in totally-enclosed, tube-cooled machines, is discussed. The effect of losses due to temperature effects is described. The calculation of the losses and the categories of stray losses are discussed with respect to the various temperature gradients. Results obtained using the modified technique are compared with results obtained from standard method of analysis.
Author

N71-36616 National Lending Library for Science and Technology, Boston Spa (England).
THE HIGH/LOW NOISE LEVEL DEVICE ON HIGH-BREAKING-CAPACITY FREE-JET CIRCUIT-BREAKERS
K. Kriechbaum 10 Mar. 1971 10 p refs Transl. into ENGLISH from Tech. Mitt. AEG-Telefunken (West Germany), v. 59, no. 2, 1969 p 99-103
(NLL-CE-Trans-5365-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The noise nuisance caused by high velocity air-blast circuit-breakers installed near built-up areas is considered. A counter-measure applied to the free jet circuit-breaker known as the high-low noise level device, which operates automatically to control the intensity of the air-blast is described. Details are given of the air valve arrangements used.
Author

N71-36617 National Lending Library for Science and Technology, Boston Spa (England).
SCHOTTKY DIODES
K. Heime 1 Jun. 1971 40 p refs Transl. into ENGLISH from Der Fernmelde Ing. (Bad Windsheim), v. 24, no. 7, Jun. 1970

p 1-36
(NLL-PORS-Trans-2760-(9022.81)) Avail: Natl. Landing Library, Boston Spa, Engl.: 4 NLL Photocopy Coupons

Physical fundamentals which are required for the calculation of the current-voltage and capacitance-voltage characteristics of Schottky diodes are discussed. Details are given of the measurement of semiconductor properties with the aid of Schottky contacts. It is possible to make a successful quantitative determination of doping, doping gradients, trap density, work functions, and surface effects. Furthermore, the Schottky diodes are compared with the junction diodes and their main advantages including lower power dissipation, lower capacitance in forward direction, reduced storage times, negligible temperature dependency of the storage times, higher cut-off frequencies and lower noise are explained. Finally, a description is given of some components which use Schottky contacts, logarithmic converters, mixers, hybrid diodes, Schottky transistors, and Schottky barrier field effect transistors. Author

N71-38618 Stanford Univ., Calif.
STUDIES OF MICROWAVE ACOUSTIC TRANSDUCERS AND DISPERSIVE DELAY LINES
William Richard Smith, Jr. (Ph.D. Thesis) 1970 158 p
Avail: Univ. Microfilms Order No. 70-18478

The performance of multiple thin film piezoelectric transducers for generation of shear or longitudinal acoustic waves is investigated. One-dimensional plane wave acoustic fields are shown to be applicable to certain symmetry axes in appropriate piezoelectric crystals. A theoretical description is given of the operation of interdigital surface wave transducers as used in Rayleigh wave delay lines. The interdigital transducer is viewed as a passive three-port junction which is internally composed of a number of identical periodic sections connected acoustically in cascade and electrically in parallel. An experimental study of dispersive surface wave delay lines is presented. These lines utilize the fact that the lowest order Rayleigh mode of propagation becomes dispersive when the free surface is coated with an overlay of a different material.
Dissert. Abstr.

N71-38619 Washington Univ., St. Louis, Mo.
RADIATION FROM AN INFINITE, GAP EXCITED DIPOLE IMMERSED IN A RADIALLY INHOMOGENEOUS LAYER
Thomas Ralph McPherron (Ph.D. Thesis) 1970 168 p
Avail: Univ. Microfilms Order No. 70-18951

The electromagnetic radiation from an infinite length, gap excited, thick, cylindrical dipole is studied for a variety of concentric coatings. Emphasis is placed on plasma layers, which are modeled as infinite in length, isotropic, cold, and inhomogeneous in only the radial direction. The antenna radiation field is formulated as a boundary value problem by direct application of Maxwell's equations for the electric and magnetic fields. Solutions for the space wave are found by a method of steepest descent integration. For a continuously inhomogeneous layer, a solution in known functions is only obtained for a layer representing a real dielectric varying inversely with the square of the radius, and is in terms of Bessel functions of complex order and imaginary argument. Radiation field solutions are also obtained for the antenna immersed in one, two, and ten concentric, homogeneous layers, permitting approximation of a single inhomogeneous layer. Dissert. Abstr.

N71-38620 Washington Univ., St. Louis, Mo.
EXTENSION OF THE THEORY OF THE UNIJUNCTION TRANSISTOR
William Patrick Connors (Ph.D. Thesis) 1970 159 p
Avail: Univ. Microfilms Order No. 70-18942

An analysis of the unijunction transistor which takes into account both diffusion and conduction currents for extrinsic base material is presented. In order to keep the analysis analytic, recombination is neglected in zeroeth order. The steady state input and output voltage-current characteristics are derived and the results are compared with previous analyses. The voltage-current characteristic and excess carrier density distribution for a bar of homogeneous semiconducting material with an ohmic contact at one end and a contact of arbitrary injection ratio at the other end are derived for the total current both entering and leaving the injecting contact. A small signal analysis is made, using the steady state solution as the zeroeth order solution. This analysis is used to derive a three terminal small signal ac equivalent circuit for the device and to determine the first order correction to the steady state characteristics for nonzero recombination rate. Dissert. Abstr.

N71-38621 Texas Univ., Austin.
OPTIMUM TECHNIQUES FOR LINEAR FEATURE EXTRACTION
Terry Lee Henderson (Ph.D. Thesis) 1970 144 p
Avail: Univ. Microfilms Order No. 70-18249

Methods are developed for processing a set of measurements to extract their most important features. The problem is approached from the viewpoint of pattern recognition, assuming two pattern classes, with particular emphasis given to the signal-in-noise detection problem. It is supposed that the feature extractor transforms the measurements into a finite-dimensional feature space, of smaller dimension than the measurement space. This transformation, which is required to be linear, must be designed a priori using knowledge of the measurement statistics for both pattern classes. Although Gaussian statistics are assumed for the measurements, heuristic arguments are given which indicate that the methods developed may be useful even when this restriction is relaxed. The extractor is designed so as to maximize the information content of the resultant feature vector; the principal information measures are the Bhattacharyya distance, divergence, and a measure defined in terms of the probability of misclassification. Dissert. Abstr.

N71-38622 California Univ., Berkeley.
LINEAR ANTENNAS IN GYROTROPIC MEDIA
Ho-shou Lu (Ph.D. Thesis) 1969 108 p
Avail: Univ. Microfilms Order No. 70-17609

A finite cylindrical dipole antenna of arbitrary orientation in a gyrotropic medium is solved as a boundary value problem using a numerical technique. In the case of a uniaxial medium, the method supplements the integral transform method whose solution is rather restricted. In the case of a gyrotropic medium, the antenna is studied by the use of an appropriate Green's dyadic of Maxwell's equations. The results indicate that the quasi-static solution is acceptable only for a very short antenna with reasonable medium parameters. In the hyperbolic region the input resistance shows a tendency to approach infinity for an infinitesimal dipole. Another form of Green's dyadic of Maxwell's equation in a gyrotropic medium is also presented which describes the near field. Furthermore, it will reduce to the known dyadic Green's function in the case of uniaxial and isotropic media. Dissert. Abstr.

N71-38623 Washington Univ., St. Louis, Mo.
THE CHARACTERISTICS AND APPLICATIONS OF GUNN EFFECT DEVICES
Wei-Ching Tsai (Ph.D. Thesis) 1970 199 p
Avail: Univ. Microfilms Order No. 70-18957

A lumped constant equivalent circuit is described for a CW Gunn oscillator. The broadband frequency tuning performance of the oscillator was predicted from the equivalent circuit. The admittance of the active device was deduced experimentally using this model. Cavity mode switching and stability criteria are given. The amplitude and frequency modulation characteristics of the oscillator are shown to be strongly controlled by the microwave circuit. Modulation mechanisms are described. The effect of the bias circuit, including bias circuit oscillations, is explained in terms of an averaged terminal current-voltage characteristic. Stability criteria and noise considerations are discussed. An automatic frequency control circuit which stabilizes long term frequency drift and which reduces short term random FM noise is described. Dissert. Abstr.

N71-36626# Fairchild Semiconductor, Ltd., New Barnet (England).
RECENT ADVANCES IN SEMICONDUCTOR TECHNOLOGY
S. Ahmed and D. Bray *In* Polytech. of N. London Microcircuits and Their Appl. Jun. 1971 24 p refs (See N71-36625 23-10)
Avail: NTIS

10 ELECTRONICS

Includes circuit theory, and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

N71-36624*# Electronic Communications, Inc., St. Petersburg, Fla.
HYBRID MICROCIRCUIT FABRICATION AND ANALYSIS STUDY Final Progress Report, Aug. 1971
Aug. 1971 25 p ref
(Contract NAS8-25180)
(NASA-CR-119949; SIER-71-0244) Avail: NTIS CSCL 09C

Six amplifier power supplies were constructed using hybrid flip-chip beam lead techniques with face down bonding. Step stress evaluation for environmental requirements indicated that the beam leaded and flip-chip device assemblies were capable of withstanding comparable environments to assemblies using conventional device attachment procedures with no notable sign of degradation. Author

N71-36625# Polytechnic of North London (England). Dept. of Electronic and Communications Engineering.
MICROCIRCUITS AND THEIR APPLICATIONS
Jun. 1971 275 p refs Papers presented at conf. held 2-4 Jun. 1971
Avail: NTIS

Research, development, and new applications of integrated microelectronic circuits are described. Applications ranging from computers to home entertainment systems and pollution control for automobiles are discussed. For individual titles, see N71-36626 through N71-36648.

N71-36626# Fairchild Semiconductor, Ltd., New Barnet (England).
RECENT ADVANCES IN SEMICONDUCTOR TECHNOLOGY c09
S. Ahmed and D. Bray *In* Polytech. of N. London Microcircuits and Their Appl. Jun. 1971 24 p refs (See N71-36625 23-10)
Avail: NTIS

The production technologies for the silicon gate MOS and the ISOPLANAR bipolar integrated circuit are discussed in detail using the standard processing previously available as a comparison. In both cases particular emphasis is placed on the area where the technologies have impacted the more complex LSI products. Author

N71-36627# Texas Instruments, Ltd., Bedford (England).
SCHOTTKY DIODE CLAMPED TTL
R. J. Baldey *In* Polytech. of N. London Microcircuits and Their Appl. Jun. 1971 4 p (See N71-36625 23-10)
Avail: NTIS

The production of reliable Schottky barrier diodes and their application in clamped TTL circuits are discussed. A.L.

N71-36628# Mullard, Ltd., London (England).
BACKGROUND AND FUNDAMENTALS OF MOS LOGIC
G. C. Deli *In* Polytech. of N. London Microcircuits and Their Appl. Jun. 1971 19 p ref (See N71-36625 23-10)
Avail: NTIS

The history of the development of MOS logic circuits is reviewed. Discussed in some detail are: (1) basic structures; (2) processing techniques; (3) basic logic function; (4) static logic; (5) MOS static inverter; (6) static logic gates; (7) dynamic logic; (8) two phase logic; (9) ratio-less two phase logic; and (10) four phase dynamic logic. A.L.

N71-36629# Philips Gloeilampenfabrieken N. V., Eindhoven (Netherlands).
MOS PRODUCTS FOR DESK CALCULATORS
A. P. Tanis *In* Polytech. of N. London Microcircuits and Their Appl. Jun. 1971 10 p (See N71-36625 23-10)
Avail: NTIS

A brief description is given of the logical set-up of desk calculator systems along with a survey of typical components and circuits. Briefly discussed are: input; memory, arithmetic, output, control and microprogram, keyboards, and integrated circuits. A.L.

N71-36630# Mullard, Ltd., London (England).
APPLICATION OF MOS LOGIC FUNCTIONS TO SYSTEMS
G. C. Deli *In* Polytech. of N. London Microcircuits and Their Appl. Jun. 1971 15 p (See N71-36625 23-10)
Avail: NTIS

The fundamentals of MOS logic are reviewed and a general approach to the use of MOS circuits is discussed. Recommendations are given for the use of standard circuits in the design of systems, rather than customized circuits. Discussed in some detail are shift registers, random access memories, read only memories, and static and dynamic logic applications. A.L.

N71-36631# Texas Instruments, Ltd., Bedford (England).
BIPOLAR MSI
M. Mimmack *In* Polytech. of N. London Microcircuits and Their Appl. Jun. 1971 2 p (See N71-36625 23-10)
Avail: NTIS

The most popular circuit configuration encountered in bipolar medium scale integration (MSI) devices is transistor-transistor logic (TTL). In order to appreciate discussions on applications of current MSI devices, it is necessary to look at the historical reasons for the use of TTL. The development from the advent of the planar transistor, through the original resistor-transistor logic to diode transistor logic, and from this to TTL is presented. TTL devices of increasing complexity are discussed to examine how increasing skills by the circuit designer and the technologists are resulting in TTL complex devices of great sophistication and still maintaining very low equivalent costs. Author

N71-36632# Texas Instruments, Ltd., Bedford (England).
APPLICATIONS OF BIPOLAR MSI
R. B. Mann *In* Polytech. of N. London Microcircuits and Their Appl. Jun. 1971 12 p (See N71-36625 23-10)
Avail: NTIS

A few of the vast number of potential applications for recent bipolar MSI devices are presented. Discussed are: (1) shift registers; (2) adders; (3) read-only memories; (4) multiplexers/demultiplexers; and (5) rate multipliers. A.L.

N71-36633# Fairchild Semiconductor, Ltd., New Barnet (England).
DESIGN AND APPLICATIONS OF INTEGRATED MICROSYSTEMS
Robert N. Blair *In* Polytech. of N. London Microcircuits and Their Appl. Jun. 1971 20 p refs (See N71-36625 23-10)
Avail: NTIS

The electronics industry has advanced so rapidly that it has forced the component manufacturers into supplying, not only monolithic IC's and hybrid IC's, but complete integrated

microsystems (IMS), fabricated by a combination of many technologies, and performing complete subsystem functions. Evolution of IMS, state of the art, design limits, performance, reliability, quality assurance, packaging, and potential applications are discussed. Author

N71-36634# REDAC Software, Ltd., Tewkesbury (England).
THE APPLICATION OF COMPUTER AIDED DESIGN TO MICROCIRCUIT DESIGN
M. Mosley *In* Polytech. of N. London Microcircuits and Their Appl. Jun. 1971 42 p refs (See N71-36625 23-10)
Avail: NTIS

Examples are given that are typical of the techniques being used by many firms engaged in integrated circuit design. Efforts are also being made to completely automate MOS design, based upon the use of standard cells, but it is generally believed that an interactive approach is better since it leads to a more optimum chip layout, less chip size, and a better yield in production. Some interactive systems do include facilities for calling down standard cells from a library and algorithms for automatic placement and routing. The introduction of computer techniques has speeded up the design phase and is leading to more reliable designs. At the present time the cost of designing with the aid of a computer is much the same as designing by manual methods, but it is hoped that it will decrease as techniques develop. Author

N71-36635# Plessey Co., Ltd., Ilford (England).
CUSTOM AND CUSTOMER DESIGN OF INTEGRATED CIRCUITS
J. A. Chandler *In* Polytech. of N. London Microcircuits and Their Appl. Jun. 1971 10 p refs (See N71-36625 23-10)
Avail: NTIS

The economic factors, as well as the advantages and disadvantages, of special design integrated circuits are discussed. A.L

N71-36636# Fairchild Semiconductor, Ltd., New Barnet (England).
CUSTOM DESIGN USING COMPUTER AIDED DESIGN AND MICROMOSAIC TECHNIQUES
J. F. R. McMahon *In* Polytech. of N. London Microcircuits and Their Appl. Jun. 1971 27 p refs (See N71-36625 23-10)
Avail: NTIS

The realization of building large scale integrated circuits using the Fairchild Micromosaic approach has been demonstrated across a wide spectrum of the electronics industry. The applications have ranged from a data terminal system to an autopilot, and the numbers of custom chips has ranged from one to a complex system of over 20. The future of the approach is undoubtedly established and as volume production increases, the overall costs will be reduced. Author

N71-36637# REDAC Software, Ltd., Tewkesbury (England).
GRAPHIC AIDS IN CIRCUIT LAYOUT
W. S. Meadows *In* Polytech. of N. London Microcircuits and Their Appl. Jun. 1971 1 p Presentation in form of film and slides (See N71-36625 23-10)
Avail: NTIS

The possibilities arising out of the use of interactive graphics equipment on-line to a computer for design layout of circuits are discussed. Films and slides are used to show how masks were designed for integrated circuit, thick film circuit, and printed circuit board layouts. Author

N71-36638# Texas Instruments, Ltd., Bedford (England).
MOS MEMORY TECHNIQUES
C. W. Hogger *In* Polytech. of N. London Microcircuits and Their Appl. Jun. 1971 3 p (See N71-36625 23-10)
Avail: NTIS

The unique properties of MOS transistors make them ideal for use in applications where a highly regular array-like structure is found, and where high packing density and low power are important considerations. This makes memories a natural application of MOS technology. Methods are indicated for fabrication of memories of various types using MOS transistors and to describe the practical system uses of the resulting memory devices. Author

N71-36639# Plessey Co., Ltd., Ilford (England).
TECHNOLOGY FOR SOLID STATE STORAGE c09
J. D. Wilcox *In* Polytech. of N. London Microcircuits and Their Appl. Jun. 1971 2 p refs (See N71-36625 23-10)
Avail: NTIS

Many dozens of integrated circuit processes, both bipolar and MOS, have been suggested, and attempted, for making some or all of the classifications of semiconductor memory. Certain memory cell circuits and technologies have become standard products. Examples of these are discussed in (1) static and dynamic, (2) bipolar and MOS, and (3) random access and serial memories. The limitations of these circuits are identified, and the scope for improvements estimated. In each case an example is included of a novel technology which, although not currently on the market, offers significant advantages and which is likely to be on the market in the next few years. Author

N71-36640# Fairchild Semiconductor, Ltd., New Barnet (England).
SEMICONDUCTOR MEMORY SYSTEMS c09
S. Ahmed *In* Polytech. of N. London Microcircuits and Their Appl. Jun. 1971 24 p refs (See N71-36625 23-10)
Avail: NTIS

Major criteria to be considered by a memory system designer when selecting a semiconductor memory are presented. Reference is drawn to the experience gained when combining a 256-bit bipolar memory device in a DIP together with a sophisticated usage of two-layer printed circuit boards. This experience was gained when delivering the first commercially available random access LSI computer main memories for the Illiac 4 computer. These techniques can supply main memories for systems ranging from minicomputers to Illiac 4 computers at a price per bit of approximately the same for either LSI memory components or for completely wired memory systems. Author

N71-36641# Texas Instruments, Ltd., Bedford (England).
CONSUMER INTEGRATED CIRCUITS
P. Jefferson *In* Polytech. of N. London Microcircuits and Their Appl. Jun. 1971 4 p (See N71-36625 23-10)
Avail: NTIS

Two integrated circuits designed especially for the home entertainment industry are described. The circuits are for use as the output stage in audio frequency amplifiers and an output for driving the line-output stage of a television receiver. Author

N71-36642# Fairchild Semiconductor, Ltd., New Barnet (England).
OPTIMISED LINEAR INTEGRATED CIRCUIT DESIGN TECHNIQUES
Derek Bray *In* Polytechnic. of N. London Microcircuits and Their Appl. Jun. 1971 36 p refs (See N71-36625 23-10)
Avail: NTIS

Some design guidelines for linear integrated circuits are presented. Also discussed is the necessity of combining circuit design techniques with a variety of different semiconductor diffusion processes to obtain optimized performance. Several examples are given showing how specific products rely on this combination of technical expertise. Author

N71-36643# Plessey Co., Ltd., Ilford (England).
LINEAR INTEGRATED CIRCUITS IN COMMUNICATIONS
J. R. Whitbread *In* Polytech. of N. London Microcircuits and Their Appl. Jun. 1971 4 p (See N71-36625 23-10)

Avail: NTIS

Linear integrated circuits developed for use in radar equipment and SSB receivers are described. Also discussed are circuits that are being developed for use in the telecommunications industry. These include devices for: (1) speech handling side of line telephone systems; and (2) amplifiers with remote dc gain control for post office requirements. A.L.

N71-36644# Plessey Co., Ltd., Ilford (England).
HIGH-SPEED COUNTERS USING BIPOLAR TECHNIQUES
C. J. Davies *In* Polytech. of N. London Microcircuits and Their Appl. Jun. 1971 1 p (See N71-36625 23-10)
Avail: NTIS

A brief description of the requirements made of a bipolar process to fabricate high speed (1 nsec) logic gates is presented together with the fundamental design considerations necessary to exploit the process fully. A counter element is described capable of operating at 600MHz with a power dissipation of 65 mW. Author

N71-36645# Plessey Co., Ltd., Ilford (England). Microelectronics Div.
THIN FILM ACTIVE FILTERS c26
S. J. Green *In* Polytech. of N. London Microcircuits and Their Appl. Jun. 1971 6 p refs (See N71-36625 23-10)
Avail: NTIS

A description is given of how hybrid techniques can be successfully employed in the construction of active filters. The use of thin film, although not mandatory, has been shown to yield a simple and elegant method ideally suited for equipments using microelectronic circuitry. Author

N71-36646# Motorola Semiconductors, Ltd., East Kilbride (Scotland).
APPLICATIONS OF INTEGRATED CIRCUITS IN THE AUTOMOTIVE INDUSTRY
M. W. Larkin *In* Polytech. of N. London Microcircuits and Their Appl. Jun. 1971 9 p (See N71-36625 23-10)
Avail: NTIS

Due to the increased sophistication of road vehicles and the more stringent requirements for safety and pollution control, a need is being created for electronic control systems in vehicles. Some of these systems are replacing existing functions on the vehicle but others are meeting new requirements. A review of these functions indicates that, providing the initial phase of introduction can be smoothed out, the utilization of integrated electronics in the automotive industry will be quite widespread. Author

N71-36647# Bendix Corp., Kansas City, Mo.
HIGH FREQUENCY PARAMETER TECHNIQUES Final Report
Dennis C. Martin Mar. 1971 51 p refs
(Contract AT(29-1)-613)
(BDX-613-347) Avail: NTIS

The measurement of hybrid transistor parameters at frequencies above 100 megahertz is discussed. Problems are created since effective opens and shorts are hard to obtain and short circuits frequently cause oscillation in the device being measured. A different set of parameters developed for high frequency measurements is used to represent a transistor. These are known as scattering or s-parameters. Direct mathematical relationships exist between scattering and hybrid parameters so that hybrid values can be calculated from measurable scattering values. Author

N71-36648# Oak Ridge National Lab., Tenn.
COMPUTER PROGRAMS FOR SOME EDDY CURRENT PROBLEMS, 1970
W. A. Simpson, J. W. Luquire, C. V. Dodd, and W. G. Spoeri Jun. 1971 281 p
(Contract W-7405-eng-26)
(ORNL-TM-3286) Avail: NTIS

Computer programs are presented for solving some eddy-current problems frequently encountered in nondestructive testing. Operating instructions and examples are given for each program. These programs are written in BASIC language and may be used on a time-sharing computer. Various eddy-current tests can be quickly and accurately designed by utilizing these programs. Author

N71-36649# Sandia Labs., Albuquerque, N.Mex.
TRANSMISSION LINE COUPLED TO A CYLINDER IN AN INCIDENT FIELD
Ronold W. P. King (Harvard Univ., Cambridge) and Charles W. Harrison, Jr. May 1971 21 p refs
(SC-R-713250) Avail: NTIS

An approximate formula is derived for the currents in the loads terminating a two-wire line located parallel to and near a circular conducting cylinder of finite length. The line and the cylinder are illuminated by an incident plane wave. The analysis takes into account the coupling between the line and the cylinder and the effects of possible axial resonances in the latter. The configuration simulates exposed conductors used to interconnect the electronic apparatus in a rocket. The analysis is directed toward determining possible hazards due to induced currents. Author

N71-36650# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TECHNIQUES OF SHAPING HIGH-VOLTAGE NANOSECOND PULSES
G. A. Vorobev et al 23 Mar. 1971 170 p refs Transl. into ENGLISH of the publ. "Tekhn. Formirovaniya Vysokovoltnykh Nanosekundnykh Impulsov" Moscow, 1963 p 1-167
(AD-726793; FTD-HC-23-643-70) Avail: NTIS CSCL 14/2

The monograph is the first attempt at a systematic presentation of material on the technique of shaping high-voltage nanosecond pulses. A considerable portion of the book is made up of the authors' works started at the high-voltage laboratory of Tomsk Polytechnic Institute in 1957 on the initiative of the Doctor of Physicomathematical Sciences Professor A. A. Vovob'yov. Description of devices for obtaining and converting the high-voltage nanosecond pulses is preceded by an analysis of the basic processes taking place in a spark with account taken of Weizel and Rompe theories and of the theory of streamer discharge and transient processes in a discharge circuit. Author (GRA)

N71-36651 New Mexico Univ., Albuquerque.
AN APPROACH FOR SUBOPTIMAL FEEDBACK CONTROL
Ronald Deen Andrews (Ph.D. Thesis) 1970 168 p
Avail: Univ. Microfilms Order No. 70-18184

Primary emphasis is on linear, time-optimal regulator systems. Control policies are specified, each of which will produce a stable system and a suboptimal performance that can be measured against optimal. Performance deviation from optimal is parametrically bounded. A hierarchy of policies can be determined by varying the parameter. The patterns that characterize the controller design problem for linear time-optimal regulator systems are investigated. Certain mappings that arise in the optimal solution are discussed, as well as their use in determining the topological and smoothness characteristics of the patterns. A set of FORTRAN subroutines is provided for computing patterns. The control of linear systems is considered, where fuel consumption and response speed are important. A time-invariant feedback policy based on the patterns for the time-optimal problems is suggested. Dissert. Abstr.

N71-36652 Louisiana State Univ., Baton Rouge.
APPLYING FEEDBACK AND FEEDFORWARD CONTROL
John Anthony Miller (Ph.D. Thesis) 1970 147 p
Avail: Univ. Microfilms Order No. 70-18548

Five topics concerned with applying feedback and feedforward control are considered. The first topic provides a comparison of tuning techniques. The results showed which modeling technique and tuning relations were best. The second topic considered was how to apply feedforward control. Overall this treatment provided a procedure for developing feedforward controllers. The third topic considered the use of search technique to determine optimal switching times. The results showed that use of a search technique was superior to other theoretical approaches particularly for higher order batch processes. The fourth topic considered a comparison of optimal and suboptimal controllers. It was shown that for a given control problem, there is definitely a point of diminishing returns when adding additional state variables to the controller. The final topic considered the dynamic modeling and control of a distillation column. Dissert. Abstr.

N71-36853 Stanford Univ., Calif.
A RAY THEORY ANALYSIS OF MAGNETOELASTIC WAVE PROPAGATION IN FERRIMAGNETIC MEDIA
Robert Chancellor Addison (Ph.D. Thesis) 1970 160 p
Avail: Univ. Microfilms Order No. 70-18371

Magnetoelastic wave propagation at microwave frequencies in single-crystal yttrium iron garnet of various nonellipsoidal geometries has been investigated experimentally in connection with delay-line applications. The detailed nature of the energy paths is examined in a cylindrically symmetric geometry from the viewpoint of geometrical ray theory, and the results of an experiment in which some of the characteristics of the acoustic beam generated in the delay line were measured are reported. Finally, the possibility of magnetically scanning and focusing an acoustic beam by utilizing the magnetoelastic interaction was investigated. It is concluded that in an axially magnetized rod, magnetostatic waves are excited at the end face, transforming to spin waves and ultimately to acoustic waves. The mechanism is consistent with experimental observations. Dissert. Abstr.

N71-36854 Iowa State Univ. of Science and Technology, Ames.
DIGITAL COMPUTER CALCULATION OF CORONA THRESHOLDS IN NONUNIFORM FIELDS
Mohamed Said Abou-Seada (Ph.D. Thesis) 1970 174 p
Avail: Univ. Microfilms Order No. 70-18876

A theoretical method for calculating the corona threshold in the nonuniform electric field of unipolar and bipolar twin-bundle conductor systems, with ground included, is described and a mathematical model representing the actual physical processes that lead to corona in a nonuniform field is formulated. A computer program is developed that calculates the potential and electric field distribution anywhere in the gap of the twin-bundle line against ground with an accuracy of better than 99.9%. Another program is developed that uses the accurately calculated electric fields together with the mathematical model and solves for the corona threshold of twin unipolar and bipolar bundle conductors, as well as single conductors. The corona thresholds computed are in close agreement with values measured experimentally. Dissert. Abstr.

N71-36855 Washington Univ., St. Louis, Mo.
AN ANALYSIS OF BINARY CIRCUITS UNDER MARGINAL TRIGGERING CONDITIONS
George Robert Couranz (Ph.D. Thesis) 1970 144 p
Avail: Univ. Microfilms Order No. 70-18943

Various methods for handling the asynchronous interaction of signals are investigated. The basic synchronizer circuit, used in many clocked systems, and the interlock, postulated to mediate control signal interaction in asynchronous systems, are shown to fail under certain realizable conditions. The failure is traced to flip flops used as state indicators in these control circuits. The basic flip flop is modeled as a simple negative resistance device with load. Stable and semistable or metastable states are defined. The time required for the flip flop output voltage to stabilize after triggering is investigated. Large variations in switching time are observed when the trigger pulse drives the circuit operating point to the metastable point corresponding to the intersection of the circuit negative resistance region and the load line. Dissert. Abstr.

N71-36856 California Univ., Los Angeles.
AN INVESTIGATION AND IMPLEMENTATION OF THE PAD RELOCATION TECHNIQUE FOR INTERCONNECTING LARGE SCALE INTEGRATED SEMICONDUCTOR CIRCUIT ARRAYS OF IMPERFECT YIELD
Donald Floyd Calhoun (Ph.D. Thesis) 1970 382 p
Avail: Univ. Microfilms Order No. 70-19836

The pad relocation technique is described which makes possible the interconnection of full-wafer LSI arrays containing defective circuits with a minimal amount of unique interconnect per array. Only a portion of one of typically three interconnect levels varies from array to array, and that variation is independent of the particular logic equations being implemented. The relationships that exist between characteristics of the array fabrication, cell complexity, yield, multi-level metalization, routing efficiency, and logic regularity are discussed. The methodology and applicability of the pad relocation technique are described. The design and successful implementation of a high complexity logic array using pad relocation are reported in addition to extensive design considerations such as yield analysis, master pattern definition, and algorithms for pad relocation routing. Extensive evaluation is also made of actual wafer yield patterns and the resulting effects on master pattern definition and array interconnection. Dissert. Abstr.

N71-36857 California Univ., Los Angeles.
APPLICATION OF THE VOLTERRA SERIES TO THE ANALYSIS AND DESIGN OF AN ANGLE TRACKING LOOP
Mark Irwin Landau (Ph.D. Thesis) 1970 185 p
Avail: Univ. Microfilms Order No. 70-19864

The analysis and design of a nonlinear feedback control system, called an angle tracking loop are discussed. For the tracker with a general polynomial nonlinearity, an arbitrary initial error and a bounded deterministic input, a method is developed for finding upper bounds on the magnitude of the tracking error (after expressing it in a Volterra series). Convergence regions of the Volterra series are also obtained. General expressions approximating the transient statistics (i.e., mean and variance) of the tracking error are developed for the angle tracker with a nonlinearity which can be represented by a polynomial. These expressions are capable of including the effects of deterministic inputs, random initial errors and random Gaussian input processes. Applications of these results are made to a second order tracking device. Dissert. Abstr.

N71-36858 Louisiana State Univ., Baton Rouge.
DIGITAL CONTROL OF PROCESSES
Armando Benito Corripio (Ph.D. Thesis) 1970 209 p
Avail: Univ. Microfilms Order No. 70-18524

The frequency response of closed-loop digital control systems that use conventional digital control algorithms including proportional-plus-integral (PI), proportional-plus-integral-plus-derivative (PID), deadbeat, and non-minimal algorithms are investigated. The results are presented in the form of plots of the ratio of the amplitude of the controlled variable to the amplitude of the input signal versus frequency. The technique of dynamic programming is used to calculate optimal feedback control policies for nonlinear systems. The algorithm thus obtained is in the form of a table of values of the manipulated variable as a function of both the state of the system and the time remaining in the process. The technique is illustrated by calculating the optimal temperature schedule for a batch reactor. Analog and digital computers were used to simulate the systems studied. Dissert. Abstr.

N71-36859 New Mexico Univ., Albuquerque.
OPTIMAL CONTROL OF BILINEAR SYSTEMS AND SYSTEMS LINEAR IN CONTROL
Seng Fi Moon (Ph.D. Thesis) 1969 182 p
Avail: Univ. Microfilms Order No. 70-17288

A computational method, called the switching-time-variation method, is introduced and developed for a certain class of optimal control problems of bilinear systems and more general systems in which the control appears linearly in the state equation. The concept of switching-time-variation is introduced to handle the non-singular optimal control problems of these systems. The application of switching-time-variation to actual problems is carried out by the gradient algorithm. In a general gradient algorithm, the functional gradient of the cost functional with respect to the control functions must be computed. In the switching-time-variation method, however, the gradient of the cost function (not a functional) of the switching-times must be computed. First the switching-time-variation method is discussed for problems with bang-bang control. Then its application is extended to fuel-optimal control problems and problems with constraints on the derivatives of the control variables. The switching-time-variation method is compared with some other computational methods. Dissert. Abstr.

N71-36860 California Univ., Berkeley.
COMPUTER DESIGN OF TEMPERATURE DESENSITIZED INTEGRATED SELECTIVE AMPLIFIERS
William Joseph Walsh (Ph.D. Thesis) 1969 223 p
Avail: Univ. Microfilms Order No. 70-17879

A computerized technique which is useful for the investigation and design of temperature desensitized integrated selective amplifiers is presented. Charge storage, base resistance, basewidth modulation and dc collector current effects are modeled in the active devices. The technique allows a selective amplifier to be described in either of two ways: as a single-loop feedback structure or as a network topology. A computer program ROOTPRO performs the automatic design of the single-loop structure while a second computer program ELTPRO performs the same design on the network topology. The programs are used here to compare different selective amplifier designs and the effects that realistic device models have on the amplifier's performance. Dissert. Abstr.

N71-36861 New York Univ., N.Y. School of Engineering and Science.
ANALYSIS AND DESIGN OF MULTICONDUCTOR DISTRIBUTED STRUCTURES WITH APPLICATION TO MICROELECTRONIC CIRCUITS
George Edward Hauck (Ph.D. Thesis) 1969 167 p
Avail: Univ. Microfilms Order No. 70-9780

Analysis and design techniques applicable to inhomogeneous multiconductor distributed circuits are considered by: derivation of the 2n-port parameters describing such structures, study of these parameters so as to reveal possible network applications, and development of design procedures for handling such cases. The problem of designing (URC)2 networks to yield voltage transfer functions with prescribed magnitude characteristics is considered. The results of the analysis are used in the formulation of an approximate design procedure utilizing dominant poles and zeros. For those cases where the design specifications are excessively complicated, a computer-aided design procedure is also given. Here, too, the dominant pole-zero design is employed to provide good initial estimates for the secondary (URC)2 parameters. Dissert. Abstr.

N71-36862 New York Univ., N.Y. School of Engineering and Science.
IMPROVING THE PERFORMANCE OF DELTA MODULATORS BY STUDYING THEIR PERFORMANCE FOR REALISTIC NONRANDOM INPUTS
Stephen Joseph Brolin (Ph.D. Thesis) 1969 292 p
Avail: Univ. Microfilms Order No. 70-19278

Models for internally generated noise in delta modulators are developed, primarily for typical deterministic inputs. In addition, stability criteria are introduced and techniques for best design compromise between stability and internal noise are presented. In the first part of the thesis a model is developed which generates the spectrum of the internally generated noise of a single-integration delta modulation system with a constant nonoverload input slope. A delta modulator with a second integrator is next analyzed. The overload problem is also considered. The most promising method for overcoming overload is to adaptively switch the delta modulator slope in accordance with the input signal, and extract all the needed information form the transmitted bit stream. Two typical adaptive algorithms are compared with respect to performance and complexity. Dissert. Abstr.

N71-36863 California Inst. of Tech., Pasadena.
STOCHASTIC OPTIMAL CONTROL
Benjamin Nathaniel Early (Ph.D. Thesis) 1970 109 p
Avail: Univ. Microfilms Order No. 70-18035

The differential equation was obtained satisfied by the optimal feedback control law for a stochastic control system in which the plant dynamics and observations are perturbed by independent additive Gaussian white noise processes. However, the differentiation includes the first and second functional derivatives and, except for a restricted set of systems, is too complex to solve. This investigation studies the optimal control law for the open loop system and incorporates it in a suboptimal feedback control law. This suboptimal control law's performance is at least as good as that of the optimal control function and satisfies a differential equation involving only the first functional derivative. The solution of this equation is equivalent to solving two two-point boundary valued integro-partial differential equations. Dissert. Abstr.

N71-36864 Purdue Univ., Lafayette, Ind.
NEGATIVE RESISTANCE AMPLIFIERS WITH PRESCRIBED TIME DELAY
Guy Terrance Cotter (Ph.D. Thesis) 1970 108 p
Avail: Univ. Microfilms Order No. 70-8619

A synthesis procedure is presented for prescribed group time delay over a finite frequency band for a certain class of active networks. These networks consist of a circulator and a negative resistor in conjunction with positive R's, L's and C's. The development of the synthesis rests upon the judicious selection of the system transfer function. This is chosen so that not only the time delay but also the gain response is acceptable in some sense over the band. As a result, the device is more useful as an amplifier. Once the transfer function is obtained, the synthesis can immediately be implemented. For the class of systems under consideration this essentially involves the design of a lossless ladder network terminated by a resistance. Dissert. Abstr.

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N71-36865*# Cornell Univ., Ithaca, N.Y. Coll. of Engineering.
CONTROL ELEMENTS FOR AN UNMANNED MARTIAN ROVING VEHICLE Progress Report, 1 Jul. 1970 - 30 Jun. 1971
R. L. Wehe and R. E. Osborn 1 Jul. 1971 54 p refs
(Grant NSR-33-010-055)
(NASA-CR-122944; MRV71-1) Avail: NTIS CSCL 13F

Progress is reported on the development of a Martian Roving Vehicle simulator to act as a test platform in the development of obstacle sensors for an autonomous roving vehicle. A short-range tactile sensor and a medium-range laser rangefinder sensor are described along with modifications to the soil sampler-tester. Author

N71-38666*# Poly-Scientific Div., Litton Precision Products, Inc., Blacksburg, Va.
THE SYNERGISTIC EFFECTS OF SLIP RING-BRUSH DESIGN AND MATERIALS Interim Report, Mar. - Jun. 1971
N. E. Lewis, S. R. Cole, and E. W. Glossbrenner Jul. 1971 86 p refs Submitted for publication
(Contract NAS5-21146)
(NASA-CR-122988) Avail: NTIS CSCL 14B

The preliminary results of a program involving the design, fabrication, and subsequent testing of four power slip rings for vacuum application are presented. Details of the environmental and instrumentation systems necessary for monitoring electrical noise, friction, and brush wear under earth-bound conditions and a vacuum condition of less than 50 ntorr are described. The four material combinations represented are evaluated during run-in at 150 rpm under ambient conditions and during a humidity sequence at 0.1 rpm. Electrical noise, friction, and brush wear data recorded during these periods are discussed. Significant among the conclusions was that after 1.2 million inches of ring travel all material combinations exhibited small quantities of wear debris, displayed no apparent correlation between the parameters of electrical noise, friction, and brush wear and humidity, and no differences in noise level were found to exist between inductive and resistive loading. Author

N71-38667# California Univ., Livermore. Lawrence Radiation Lab.
ENGINEERING DESIGN OF THE 2X 2
C. J. Anderson, T. H. Batzer, M. O. Calderon, and G. E. Vogtlin 12 Mar. 1971 19 p refs Presented at the 4th Symp. on Eng. Probl. of Fusion Res., Washington, D. C., 20 Apr. 1971 Sponsored by AEC
(UCRL-73060; Conf-710418-1) Avail: NTIS

The engineering aspects of the facility, including the magnetic and mechanical design of the magnet system, the attendant structure, and the vacuum system are described. Material problems are discussed as well as the scheduling, fabrication, and assembly of the facility. Design problems associated with the injection of a neutral beam are included. Author (NSA)

N71-38668# California Univ., Livermore. Lawrence Radiation Lab.
ENGINEERING THE BASEBALL MAGNET SYSTEM
C. D. Henning, R. L. Nelson, A. K. Chargin, B. S. Denhoy, and F. Harshbarger 1970 11 p refs Presented at the 4th Symp. on Eng. Probl. of Fusion Res., Washington, D.C., 20 Apr. 1971 Sponsored by AEC Submitted for publication
(UCRL-73067; Conf-710418-3) Avail: NTIS

The Baseball 2 magnet system has satisfactorily completed engineering testing at LRL. Over a three-day period the magnet was lowered to 30 K by a helium refrigerator. Then the magnet was filled with liquid helium from the 10,000-liter storage dewar and energized to about 75% of its capability. The electrical and magnet quench systems performed satisfactorily. However, helium loss rates were greater than necessary because the permanent heat shield was not installed. A plasma beam line is being completed that incorporates superconducting magnetic shielding to protect the injected beam from the Baseball fringe field. Author (NSA)

N71-38669# California Univ., Berkeley. Lawrence Radiation Lab.
FACTORS WHICH WILL AFFECT THE COST OF A SUPERCONDUCTING SYNCHROTRON
Michael A. Green 17 Feb. 1971 25 p refs Presented at the HEPAP Subpanel on Advance Accelerator Technol., Berkeley, Calif., 7 Jan. 1971
(Contract W-7405-eng-48)
(UCRL-20299; Conf-710111-1) Avail: NTIS

The effects of the more important machine parameters on synchrotron cost are studied. Published cost estimates of the LRL and BNL superconducting synchrotron studies are presented. These costs are compared with published cost data for the NAL conventional synchrotron. Some rough conclusions about the effects of aperture and dipole magnet field can be drawn from these already published cost data. In order to show more clearly the effects of machine parameters on cost, consistent cost-estimating procedures are applied to a wide variety of machines with various dipole magnetic fields, magnet apertures, and machine cycle times. The cost of machines using a highly advanced nonexistent beta tungsten type of material is compared with machines using a practical Nb-Ti material now available. The basic assumptions used in the cost estimating process are described. The basic machine parameters used in the estimate are discussed. The results of consistent cost calculations using the CDC 6600 computer are presented in tabular and graphical form. Author (NSA)

N71-38670# European Space Research and Technology Centre, Noordwijk (Netherlands). Control and Stabilization Div.
DESIGN OF A SINGLE-AXIS MOTION SIMULATOR FOR DEVELOPMENT AND PERFORMANCE TESTING OF SATELLITE ATTITUDE CONTROL SYSTEMS
I. Rizos Paris ESRO Apr. 1970 179 p refs
(ESRO-TR-8-ESTEC) Avail: NTIS

For the development and performance testing of satellite attitude control systems, a single axis wire-suspended motion simulator was developed. It provides, for one axis of freedom, all relevant properties of space which affect attitude control system performance, i.e. negligible restoring torque and Coulomb and viscous friction. The system under test is mounted on the simulator platform, where its performance may be observed, measured, and evaluated under space conditions. In addition, the use of an air bearing makes it possible to achieve a long period oscillation mode with periods of more than six hours. The design of the simulator with all its components is reported, along with their performance details (except the air bearing), the tests which may be performed with it, and calibration procedures. Author (ESRO)

N71-38671# ARO, Inc., Arnold Air Force Station, Tenn.
ELECTRON BEAM PROBE FOR A LOW DENSITY HYPERSONIC WIND TUNNEL Final Report, 1 Dec. 1969 - 30 Jun. 1970
W. D. Williams, J. O. Hornkohl, and J. W. L. Lewis AEDC Jul. 1971 108 p refs
(Contract F40600-72-C-0003)
(AD-727004; AEDC-TR-71-61; ARO-VKF-TR-70-313) Avail: NTIS CSCL 14/2

The purpose of the experiments and calculations reported was to use the electron beam technique for rotational and vibrational temperature and density measurements in the free stream of low density, hypersonic flows of nitrogen. The variation in the flow parameters was obtained through the use of four different nozzles; each was operated at two different conditions. The electron beam was injected through the flow, and the resulting spontaneous emission of light was spectroscopically analyzed. Light intensity measurements were made photoelectrically, and signal amplification and averaging were accomplished with a lock-in amplifier. Author (GRA)

N71-38672*# National Aeronautics and Space Administration Flight Research Center, Edwards, Calif.
MOTION CUE AND SIMULATION FIDELITY ASPECTS OF THE VALIDATION OF A GENERAL PURPOSE AIRBORNE SIMULATOR

Kenneth J. Szalai Washington Oct. 1971 36 p refs
(NASA-TN-D-6432; H-648) Avail: NTIS CSCL 14B

In the validation of the general purpose airborne simulator, certain motion and visual cues could not be duplicated because the airborne simulator could not be independently controlled in six degrees of freedom. According to pilot opinion, however, the XB-70 airplane at two flight conditions has been simulated satisfactorily. Because of the dependence of simulation results on simulator configuration, two areas were investigated after the validation program was completed. The first was the effect of mismatched cues on observed handling qualities. Experiments which varied lateral acceleration at the pilot's location and yaw rate, while keeping constant the lateral-directional dynamics displayed on the pilot's instruments, showed pilot sensitivity to directional motion cues to be different for the simulation of two XB-70 flight conditions. A technique for allowing consecutive evaluations of moving- and fixed-base configurations in flight was used successfully to determine motion cue effects. The second area investigated was the measurement and description of simulation fidelity. In-flight frequency-response measurements of the model-following system were taken to examine model-following fidelity for directly matched variables such as sideslip and roll rate as well as uncontrolled parameters such as lateral acceleration. Author

N71-38673*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CALIBRATION OF THE LANGLEY MACH 20 HIGH REYNOLDS NUMBER HELIUM TUNNEL INCLUDING DIFFUSER MEASUREMENTS
Ralph D. Watson and Dennis M. Bushnell Washington Oct. 1971 43 p refs
(NASA-TM-X-2353; L-7756) Avail: NTIS CSCL 14B

Detailed flow characteristics in the Mach 20 leg of the Langley high Reynolds number helium tunnels have been determined for stagnation pressures from 207 to 1379 N/sq cm (300 to 2000 psia) at ambient stagnation temperature. For this range of stagnation pressure the free-stream Mach number varies from 16.7 to 18.4 in the Reynolds number range from 7,800,000 to 48,800,000 per meter. The axial Mach number gradient has been found to be 0.125 per meter and the inviscid core approximately 50.8 cm. in diameter with a probable length of 1060 cm. Nondimensional radial distributions obtained previously in the Langley 22-inch helium tunnel. Pressures measured along the sidewall of the diffuser are presented and analyzed to determine flow conditions within the diffuser as back pressure rises during a run. These flow conditions were determined to insure that undue loads due to unusual flow conditions were not placed on a large butterfly valve downstream of the diffuser. Author

N71-38674# Cincinnati Univ., Ohio. Design Research Collaborative.
ADVANCED LIGHTWEIGHT PORTABLE STRUCTURAL CONCEPTS FOR SHELTERS, HANGARS AND MAINTENANCE DOCKS Final Technical Report, 21 Apr. 1969 - 30 Sep. 1970
W. Randall Wakefield, James M. Alexander, Karl H. Mertel, and Jack R. Farrah Wright-Patterson, Ohio AFD 1971 358 p refs
(Contract F33615-69-C-1719)
(AD-727068; ASD-TR-71-34) Avail: NTIS HC $8.00/MF $0.95 CSCL 13/13

A lightweight, high-mobility structural concept for shelters used primarily for general purposes. Hangars used for temporary aircraft storage, and maintenance docks for support of aircraft maintenance crews is presented. Five shelter concepts are described. Several offer modular growth patterns. Four hangar concepts are described. Six maintenance dock concepts are described. The designs are both the aircraft-enclosing type and the access-platform type. One universal panel and beam shelter capable of various spans and shapes is discussed. Models were built of twelve of the concepts for design evaluation. Structural design feasibility analyses were performed and are included as an appendix. Author

N71-38675*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
RAPID ESTIMATION OF WIND-TUNNEL CORRECTIONS WITH APPLICATION TO WIND-TUNNEL AND MODEL DESIGN
Harry H. Heyson Washington Sep. 1971 370 p refs
(NASA-TN-D-6416; L-7793) Avail: NTIS HC $8.00/MF $0.95 CSCL 14B

A chart method is developed for the rapid estimation of wind tunnel interference in closed and closed-on-bottom-only tunnels. In addition, testing limit charts, based on varying degrees of correction, are developed. Applications of these results indicate very powerful effects of wing sweep and the degree of correction on the usable testing range of wind tunnels. Author

N71-38676 Rensselaer Polytechnic Inst., Troy, N.Y.
STATISTICAL STUDY OF THE PRESSURE FLUCTUATIONS IN A FLUIDIZED BED
Rufino C. Lirag, Jr. (Ph.D. Thesis) 1970 162 p
Avail: Univ. Microfilms Order No. 70-19943

A physical interpretation of pressure fluctuations in randomly bubbling beds is presented. The different properties of the pressure signals such as the different moments, probability density, correlation, and spectral density functions were obtained and correlated with the dynamic characteristics of fluidized beds. The effects of the different bed parameters (static bed height, gas flow rate, particle size and density) on the character of the pressure signals and properties of the bed were also obtained. Fluidized beds of copper and glass particles in a cylindrical column as the fluid phase were used. As established by the autocorrelation and power spectral density function, the pressure signals obtained have a periodic component. It is shown that for deep beds the pressure fluctuations in the bed and the plenum are caused by escaping bubbles. Dissert. Abstr.

N71-37457# Academy of Sciences (USSR), Moscow.
STUDY OF COSMIC PHENOMENA IN THE LABORATORY
I. M. Podgorny *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 206-211 refs In RUSSIAN (See N71-37429 23-30)
Avail: NTIS

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N71-38677*# Wyle Labs., Inc., Huntsville, Ala. Research Div.
PREDICTION OF IN-FLIGHT FLUCTUATING PRESSURE ENVIRONMENTS INCLUDING PROTUBERANCE INDUCED FLOW
J. E. Robertson Mar. 1971 88 p refs
(Contract NAS8-25700)
(NASA-CR-119647; WR-71-10) Avail: NTIS CSCL 20D

An investigation of the transonic fluctuating pressure environments is presented. Based on test results from many sources, prediction methods for various unsteady flow environments are formulated. In particular, prediction methods are proposed for basic fluctuating pressure phenomena which occur on virtually all aerospace vehicles during some phase of launch and protuberance induced fluctuating pressure phenomena which are typical of three-dimensional protuberances attached to the external surfaces of a vehicle. The prediction methods for the basic fluctuating pressure phenomena were developed for two-dimensional and axisymmetric configurations; however, the conclusions are of fairly general application. The

prediction of overall levels, spectra and cross-spectra for both basic and protuberance induced fluctuating pressure phenomena are compared to show characteristics unique to the particular unsteady flow condition. Author

N71-38678*# Scientific Translation Service, Santa Barbara, Calif.
FLOW IN THE NEAR WAKE [TECHENIYE V BLIZHNEM SLEDE]
I. Yu. Brailovskaya Washington NASA Oct. 1971 7 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 197, 21 Mar 1971 p 542-544
(Contract NASw-2035)
(NASA-TT-F-13993) Avail: NTIS CSCL 20D

A numerical solution of Navier-Stokes equations for a compressible viscous gas is obtained in the near-wake region behind the perpendicular (to the flow surface) trailing face of a plate in supersonic flow. The velocity, density, temperature, and boundary layer parameters for the oncoming flow are known. The Navier-Stokes equations for the region of interest consist of two equations of motion, an energy equation, and a continuity equation. Pressure, density, and temperature are related by the equation of state. The viscosity and thermal conductivity coefficients are power functions of temperature. The boundary value problem for the region with specified boundary conditions was solved numerically by the finite difference method. The results for nine different cases of specified initial parameters are given graphically in the form of characteristic streamlines and pressure profiles. Author

N71-38679*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TIP VORTICES: VELOCITY DISTRIBUTIONS
N. A. Chigier and V. R. Corsiglia Sep. 1971 14 p refs Presented at the 27th Ann. Nat. Forum of the Am. Helicopter Soc., May 1971
(NASA-TM-X-62087) Avail: NTIS CSCL 20D

Detailed measurements of velocity distributions have been made in vortices generated at the tip of a square-tip, 18-inch-chord, 48-inch semispan blade mounted in the NASA-Ames 7-by 10-foot wind tunnel. Time-mean-average velocity components were measured using a triple sensor hot wire probe operated by three separate anemometers. With the blade at an angle of attack of 12 deg, traverses were made through the vortex centers at six axial stations, $x/c = -0.75$, -0.50, -0.25, 0.0, 2.0, and 4.0, where $x/c = 0$ is the trailing edge. The dimensions of the vortex increase with distance downstream over the blade surface, and at $x/c = 4$ the vortex core radius is 1.7% of the span. Maximum circumferential velocity of 42% of mainstream velocity was measured at $x/c = -0.50$, over the wing surface, followed by decay to 24.0% of mainstream velocity at $x/c = 4$. Axial velocity in excess of free stream velocity was measured in the vortex core with maximum axial velocity of 140% of free stream velocity at $x/c = -0.25$.
Author

N71-38680*# Scientific Translation Service, Santa Barbara, Calif.
INCOMPRESSIBLE POTENTIAL FLOW IN A PLANE CASCADE STAGE [DIE INKOMPRESSIBLE POTENTIAL ALSTROEMUNG IN DER EBENEN GITTERSTUFE]
Heinz J. Oellers Washington NASA Oct. 1971 11 p refs Transl. into ENGLISH from the publ. "Jahrbuch, 1962" West Germany, WGLR p 349-353
(Contract NASw-2035)
(NASA-TT-F-13982) Avail: NTIS CSCL 20D

The singularity method applied to a single cascade is transferred to the system of a double cascade (stator and rotor of a turbine stage). Systems of linear integral equations of the first kind result for the vortex distributions on the different blade sections. The unsteady character of flow is considered by approximation. The results of the evaluation, particularly for pressure distributions, are compared with those obtained for single cascades. Author

N71-38681*# Techtran Corp., Glen Burnie, Md.
THEORY OF FLOWS IN STEADY SEPARATION ZONES [KITEORII TECHENIY V STATSIYONARNYKH SRYVNYKH ZONAKH]
V. Ya. Neyland et al Washington NASA Oct. 1971 17 p refs Transl. into ENGLISH from Uch. Zap., TsAGI (USSR), v. 1, no. 1, 1970 p 14-23
(Contract NASw-2037)
(NASA-TT-F-13992) Avail: NTIS CSCL 04D

The problem of determining the limiting conditions of the flow in separation zones in the case of large values of the Reynolds number is investigated. A method of constructing a complete picture of the flow is developed upon utilizing the well-known results of Prandtl and Batchelor. An equation is derived for determining the amount of vorticity in the non-viscous part of the reverse-flow region. A simple method is proposed for the approximate calculation of the flow in the reverse-flow region for the case of small values of the vorticity.
Author

N71-38682# Technische Hogeschool, Delft (Netherlands). Lab. voor Aero- en Hydrodynamica.
THE MIXING SHOCK IN A WATERJET GAS PUMP
J. O. Hinze and J. P. Rijnders Aug. 1971 14 p ref Presented at 7th Euromech Colloq. on the Mech. of Liquids Containing Bubbles, Grenoble, France, 23-26 Apr. 1968
(WTHD-31) Avail: NTIS

A detailed investigation of the phenomena involved in the mixing shock of a waterjet ejector is conducted. The effects of pressure build up, entropy increases, physical mechanisms, and gas and liquid flow are discussed. The special experimental and measuring equipment used are described. E.H.W.

N71-38683# Technische Hogeschool, Delft (Netherlands). Lab. voor Aero- en Hydrodynamica.
EXPERIMENTAL INVESTIGATION ON SECONDARY CURRENTS IN THE TURBULENT FLOW THROUGH A STRAIGHT CONDUIT
J. O. Hinze Aug. 1971 17 p refs
(WTHD-27) Avail: NTIS

Experiments to modify the mechanical energy balance equations used to describe turbulent flow through a conduit with a large aspect ratio and a rough wall, are described. Certain terms thought to be unimportant were omitted and the following rule was developed. When in a localized region the production is much greater (smaller) than the viscous dissipation, there must be a secondary current that transports turbulence poor fluid into (outwards) this region and turbulence rich fluid outwards (into) the region. The results from measurements indicate the neglect of unimportant terms under such a rule are justified. Author

N71-38684# California Univ., Livermore. Lawrence Radiation Lab.
CALCULATION TECHNIQUES FOR ESTIMATING THE PRESSURE LOSSES FOR CONDUCTING FLUID FLOWS IN MAGNETIC FIELDS
M. A. Hoffman and G. A. Carlson 4 Feb. 1971 40 p refs
(Contract W-7405-eng-48)
(UCRL-51010) Avail: NTIS

Simple analytical relations are proposed for rapid estimation of the various ordinary and magnetic pressure drops for conducting fluid flows in magnetic fields. The relations are based on various theoretical and experimental investigations. Effects considered include magnetic suppression of turbulence and electrical eddy currents induced in the fluid due to spatial variations of either the fluid velocity or the magnetic field strength. The relations are used to estimate the upper bound on the pressure drops of lithium flow in a hypothetical fusion reactor blanket. The results indicate that the pressure drops are very sensitive to the choice of path which the pipes follow through the magnetic field region. In particular, the pressure drops can span a range of values over six orders of magnitude

from < .1 to > 100,000 psi, depending on the path and pipe wall conductance. Based on these results, it appears that the pressure drop in a Li blanket can be made acceptably small, but only through careful design. Author (NSA)

N71-36686# Argonne National Lab., Ill.
PRESSURE PULSE PROPAGATION IN TWO-PHASE ONE AND TWO COMPONENT MIXTURES
R. E. Henry, M. A. Grolmes, and H. K. Fauske Mar. 1971 88 p refs
(Contract W-31-109-eng-38)
(ANL-7792) Avail: NTIS

A comprehensive analytical development of the propagation velocity of small pressure pulses is presented for bubble, annular, stratified, droplet, and slug-flow regimes. Particular attention is given to the influence of flow regime on the momentum transfer between phases. Momentum transfer in bubbly, droplet, and wavy separated flows is described by consideration of the virtual mass of the discrete phase. For the smooth-interface-separated flows, no interaction is assumed between the phases. In the slug-flow regime, the distinction is made between inertially and acoustically limited pressure propagation, and a consideration of the severe attenuation of a finite pulse on crossing a vapor-liquid interface is shown to be of major importance. These analyses are compared with data obtained in this and other representative studies. Data obtained in this study are unique in that comparisons of the propagation velocity in one- and two-component mixtures are illustrated for widely different flow regimes. Characteristics of compression and rarefaction pulses in one-component flow are also described. Author (NSA)

N71-36686# Addis Translations International, Woodside, Calif.
RELAXATION AND NONEQUILIBRIUM RADIATION BEHIND SHOCK WAVES IN AIR
M. S. Zheleznyak May 1971 39 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza. (USSR), no. 4, 1970 p 161-174
(SC-T-713030) Avail: NTIS

Relaxation behind shock waves in air at velocities between 8 and 12 km/sec is discussed. Gas-parameter profiles behind the front are obtained, and the populations of radiative states of atoms and molecules are calculated. The spectral distribution of the radiation from the relaxation zone is determined. It is shown that in a number of spectral intervals the radiation intensity passes through a maximum exceeding the equilibrium level. The results are compared with the experimental data obtained in shock tubes. The radiant heat fluxes from the relaxation zone are calculated, and the contribution of this radiation to radiative heating of blunt bodies during hypersonic flow around them is estimated. Author

N71-36687# Argonne National Lab., Ill.
UNSTEADY COUPLED HIGH-FLUX-MASS, MOMENTUM TRANSFER WITH A MOVING BOUNDARY
Joseph Kaellis Mar. 1971 157 p refs
(Contract W-31-109-eng-38)
(ANL-7797) Avail: NTIS

The simultaneous transient developing mass and momentum boundary layers in a moving-wall (Stefan) problem resulting from the flow of a fluid through a channel with dissolving walls is calculated. The numerical solution incorporates the vorticity-stream function procedure adapted to equations which are neither Lagrangian (observer moves with the fluid) nor Eulerian (stationary observer). A flux-induced velocity, perpendicular to the wall, termed the Stefan-Nusselt effect is considered as well as a density effect which modifies the Stefan-Nusselt effect. The mathematical techniques developed are applicable to solving a class of problems in which the important consideration is the shape of the domain for the desired or optimum potential distribution. Moving-wall, separation, and free-surface problems are in this class. Author

N71-36688# Sandia Corp., Albuquerque, N.Mex.
MAGNUS DATA ON THE STANDARD 10 DEG CONE CALIBRATION MODEL
Warren H. Curry, James F. Reed, and William C. Ragsdale (NOL, White Oak, Md.) Mar. 1971 24 p refs Presented at 35th Meeting of the Supersonic Tunnel Assoc., Dallas, 8-9 Mar. 1971
(SC-DC-71-3821; Conf-710308-1) Avail: NTIS

The standard 10 deg cone calibration model was run in a supersonic wind tunnel to obtain Magnus force and moment data at Mach numbers of 1.76, 2.02, and 2.02, at respective Reynolds numbers of 2.74, 2.44, and 1.70 million based on model length. The angle of attack was varied from zero to 12 degrees and the spin helix angle ranged from zero to approximately 0.25 radians. Boundary layer transition occurred on the model at all finite angles of attack. As expected, these results were not in agreement with the theoretical predictions for the all laminar boundary layer condition. Author (NSA)

N71-36689# Sandia Corp., Albuquerque, N.Mex. Numerical Fluid Dynamics Div.
NUMERICAL SOLUTIONS OF NONEQUILIBRIUM REFLECTED SHOCK WAVES IN AIR WITH RADIATION
Victor J. Sloglund (New Mexico Univ., Albuquerque) and Charles B. Watkins, Jr. May 1971 110 p refs
(SC-RR-710203) Avail: NTIS

Numerical techniques are described for the solution of one-dimensional, nonequilibrium, radiating, reflected shock waves in air. Solutions obtained by special second-order-accurate shock-fitting and finite-difference techniques are presented, and compared with the experimental and analytical data of other investigators. The nonequilibrium processes that are considered include coupled chemical and vibrational relaxation. An optically thin radiation model is used to calculate the radiative transfer of nonequilibrium molecular bands. Author

N71-36690# Hydronautics, Inc., Laurel, Md.
NONLINEAR EFFECTS FOR TWO-DIMENSIONAL FLOWS PAST SUBMERGED BODIES MOVING AT LOW FROUDE NUMBERS
G. Degan Jun. 1971 61 p refs
(Contract N00014-71-C-0080)
(AD-728448; TR-7103-1) Avail: NTIS CSCL 20/4

The free-surface gravity flow past a cylinder is solved by inner and outer expansions in the potential plane. The linearized solution, based on an expansion in epsilon (the ratio between the radius and the depth of immersion) while F (the depth Froude number) is kept of order one, is subsequently expanded in a small F series. The second-order, nonlinear, terms are computed under this double expansion. The analysis is extended to expansions in the physical plane and to the case of a schematical thin body. The free-wave amplitude and wave resistance asymptotic sequence converges for a thickness Froude number larger than unity. Author (GRA)

N71-36691# California Univ., Berkeley. Aeronautical Sciences Div.
THE FLOW ABOUT A CIRCULAR CYLINDER AT LOW REYNOLDS NUMBERS USING THE METHOD OF SERIES TRUNCATION WITH A NOVEL COORDINATE SYSTEM
S. A. Berger, Y.-K. Cheung, and P. Raguraman Apr. 1971 33 p refs
(Contract N00014-68-A-0200-1021)
(AD-728447; AS-71-1) Avail: NTIS CSCL 20/4

Arguments are presented suggesting that choosing as one of the coordinates, the parabolas along which vorticity decay algebraically far from any finite, two-dimensional body, one may anticipate better results in applying the method of series truncation to flow about such a body. As a test, the steady, incompressible, low Reynolds flow about a circular cylinder is analyzed starting with the Navier-Stokes equations. The results obtained for the first truncation are closer to the exact Ossen solution than first and second truncations obtained using the more usual polar coordinates. Author (GRA)

N71-36892# Systems Science and Software, La Jolla, Calif.
HELP: A MULTI-MATERIAL EULERIAN PROGRAM FOR COMPRESSIBLE FLUID AND ELASTIC-PLASTIC FLOWS IN TWO SPACE DIMENSIONS AND TIME, VOLUME 1
L. J. Hageman and J. M. Walsh Aberdeen Proving Ground, Md. Ballistic Res. Labs. May 1971 146 p refs Supersedes AD-882674 2 Vol.
(Contract DAAG07-68-C-0931)
(AD-726459; BRL-CR-39-Vol-I) Avail: NTIS CSCL 09/2

Volume I details a new numerical model for solving multi-material flows which are functions of two space dimensions and time. The program, called HELP, is basically Eulerian but also contains Lagrangian features for the explicit definition of interface positions. The program is general in the sense that any number of materials can be present in a given Eulerian cell and no special difficulties arise for flows involving extreme material distortions. The program is suitable for compressible media with strength dependence. Compressibility is included by an equation of state giving pressure as a function of density and specific internal energy. Strength is included by means of a constitutive equation giving the deviatoric stresses as functions of the elastic and plastic strains. In this Volume I report, the basic equations are developed, the computer program is documented and sample results are given from six applications. Author (GRA)

N71-36893# Systems Science and Software, La Jolla, Calif.
HELP: A MULTI-MATERIAL EULERIAN PROGRAM FOR COMPRESSIBLE FLUID AND ELASTIC-PLASTIC FLOWS IN TWO SPACE DIMENSIONS AND TIME. VOLUME 2: FORTRAN LISTING OF HELP
L. J. Hageman and J. M. Walsh Aberdeen Proving Ground, Md. Ballistic Res. Labs. May 1971 124 p Supersedes AD-882675 2 Vol.
(Contract DAAG07-68-C-0931)
(AD-726460; BRL-CR-39-Vol-2; Rept-3; SR-350-Vol-2) Avail: NTIS CSCL 09/2
For abstract, see N71-36892

N71-36894# Columbia Univ., New York. Lubrication Research Lab.
ON THE FLOW BETWEEN A MOVING FLAT PLATE AND A STATIONARY CYLINDER: A STUDY OF ENTRANCE INERTIA EFFECTS ASSOCIATED WITH HIGH SPEED MAGNETIC TAPES AND COMPUTER FLYING HEADS
Dee R. Seod and Harold G. Elrod May 1971 52 p refs
(Contract N00014-67-A-0108-0021)
(AD-726464; TR-18) Avail: NTIS CSCL 09/2

To predict analytically the entrance inertia effects associated with high-speed magnetic tapes or with computer flying heads, the problem of viscous flow between a spindle and a plate moving in its own plane is considered. Numerical solutions are obtained for the complete Navier-Stokes equations. A pjeliminary observation is made on the inviscid dynamic pressure corresponding to the plate velocity in relation to the 'ambient' pressure for the Stokes and Reynolds flow within the gap. Author (GRA)

N71-36895# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
AN INVESTIGATION OF THE FLOW AROUND RECTANGULAR CYLINDERS
P. W. Bearman and D. M. Trueman Jun. 1971 25 p refs
(IC-Aero-71-15) Avail: NTIS

Measurements are presented of the base pressure coefficients, drag coefficient and Strouhal number of rectangular cylinders. The results confirm a finding in Japan that the drag coefficient rises to nearly 3 when the depth of the section is just over half the width. The flow around the sections is found to be strongly influenced by the presence of the trailing edge corners. Author

N71-36896# Rice Univ., Houston, Tex.
A CONTINUUM THEORY FOR FLUID SURFACE PHENOMENA
Robert Cleveland Clarke (Ph.D. Thesis) Dec. 1969 60 p refs
Avail: NTIS

A continuum theory for fluid surface phenomena that accounts for the interaction of the surface with the surrounding materials is presented. Of primary interest is the transport of mass into and out of the surface. The proposed theory was constructed by considering the surface or interface between two materials to be a geometrical surface but possessing finite physical properties different from those of the surrounding media. Constitutive equations for a fluid surface are studied and a linear theory is obtained. Author

N71-36897*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
CALCULATION OF NONLINEAR CONICAL FLOWS BY THE METHOD OF LINES
E. B. Klunker, Jerry C. South, Jr., and Ruby M. Davis Washington Oct. 1971 82 p refs
(NASA-TR-R-374; L-7813) Avail: NTIS CSCL 20D

A computational technique, called the method of lines, is developed for computing the flow field about conical configurations at incidence in a supersonic flow. The method, which makes use of the self-similarity property, is developed for the nonlinear flow equations. The method has proved to be an efficient and versatile procedure for constructing the numerical solutions to conical flow problems. It has been successful in computing the flow about circular and elliptic cones at conditions where small regions of supersonic cross flow develop and for the conical delta wings where the region of supersonic cross flow is extensive. The calculations made for circular and elliptic cones as well as for the compression side of various conical delta wings are in good agreement with experiment except in regions where viscous effects become important. Author

N71-36898*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
AN ANNOTATED BIBLIOGRAPHY ON TRANSONIC FLOW THEORY
Perry A. Newman and Dennis O. Allison Washington Sep. 1971 134 p
(NASA-TM-X-2383; L-7753) Avail: NTIS CSCL 20D

A listing is presented of a large number (approximately 700) of theoretical papers relating to steady inviscid external transonic flows that should be of interest primarily to analysts. The bibliography is arranged alphabetically by author and divided into four parts that include: (1) books, (2) summary papers, (3) conference proceedings, and (4) technical papers and reports. The English language entries listed in part 4 are coded to indicate what problem was discussed or solved and the method which was used. Author

N71-36899# Michigan Univ., Ann Arbor. Cavitation and Multiphase Flow Lab.
NORMAL IMPACT OF A FINITE CYLINDRICAL LIQUID JET ON A FLAT RIGID PLANE
Yen C. Huang, F. G. Hammitt, and Wei-Jei Yang Aug. 1971 28 p refs Submitted to J. Fluid Mechanics for publication
(Grant NSF GK-730)
(UMICH-03371-8-T) Avail: NTIS

The normal impact of a flat-ended cylindrical water jet of finite length upon a rigid plane is studied. Particular emphasis is given the unsteady-state portion during the initial portion of the process. The governing partial differential equations of compressible flow, neglecting body force, viscosity and surface tension, are solved numerically by a newly developed Compressible-Cell-and-Maker (ComCAM) solution method. Numerical results are first checked by solving the classical one-dimensional water hammer problem. Author

N71-36700# Michigan Univ., Ann Arbor. Cavitation and Multiphase Flow Lab.
IMPACT OF SPHERICAL WATER DROP ON FLAT RIGID SURFACE
Yen C. Huang, F. G. Hammitt, and Wen-Jei Yang Aug. 1971 28 p refs Submitted to Phys. of Fluids for publication
(Grant NSF GK-730)
(UMICH-033710-10-T) Avail: NTIS

The impact of a spherical water drop upon a rigid plane is studied. The governing partial differential equations of compressible hydrodynamics neglecting body force, viscosity, and surface tension are solved with a Compressible-Cell-and-Maker technique. Flow patterns, impact pressures, and velocities are found as a function of time. The maximum pressure attained is approximately seventy percent of the water hammer pressure. This point is considered important in estimating the damage capability of such impacts. Author

N71-36701# Michigan Univ., Ann Arbor. Cavitation and Multiphase Flow Lab.
COMPUTER SIMULATION OF HIGH SPEED COLLISION WITH RAIN DROP (COMBINED SPHERICAL-CYLINDRICAL SHAPE)
Yen C. Huang, F. G. Hammitt, and Wen-Jei Yang Sep. 1971 35 p refs Submitted to ASME for publication
(Grant NSF GK-730)
(UMICH-03371-12-T) Avail: NTIS

The numerical analysis of the collision process between a rain drop and a rigid plane is presented. Simulation of the impact was conducted to include rain drop deformation, isobar distribution within the droplet at various instants, and pressure distributions on the impact surface. Other variables such as density, velocity, and momentum were also found as a function of time. Author

N71-36702 National Lending Library for Science and Technology, Boston Spa (England).
MEASUREMENT OF PRESSURES IN VERY TURBULENT FLOWS [MESUREG DES PRESSIONS DANS LES ECOULEMENTS TRES TURBULENTS]
M. Barat 2 Mar. 1971 28 p Transl. into ENGLISH from Inform. Aerolique et Thermique (France), v. 23, 1969 p 2-23
(NLL-M-20383-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 3 NLL photocopy coupons

The effects of turbulent flow on the accuracy of pressure instrument readings are discussed. The influences of fluctuations in size and direction are explained and the resulting errors are analyzed. Mathematical models are presented and the correction factors to be applied under various conditions are reported. Author

N71-36703 National Lending Library for Science and Technology, Boston Spa (England).
NUMERICAL SOLUTION OF THE NAVIER-STOKES EQUATIONS TO CALCULATE INCOMPRESSIBLE CENTRIFUGE FLOWS
E. Krause 1 Jun. 1971 20 p refs Transl. into ENGLISH from proceedings of DFVLR Colloq. on Mech. Flow Processes in Gas Centrifuges (Porz-Wahn, West Ger.), 14 May 1970 p 93-119
(NLL-CA-Trans-251-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 3 NLL photocopy coupons

A method is given for calculating the flow processes in gas centrifuges. The solution assumes that the flow can be described by a continuum concept. The non-steady Navier-Stokes equations and the energy equation form the starting point of this work. Using finite difference approximations the complete equations of motion are integrated in a cylindrical co-ordinate system. The axial symmetry of the problem is used to transform the original three-dimensional problem to a two-dimensional problem. Then a flow function can be introduced to satisfy the continuity equation. The tangential and radial velocities of the flow are determined as dependent on time. In a final calculation the Lagrange paths of the gas particles are determined. The throughput quantity and the width and arrangement of the throughput slits can be varied within definite limits. Author

N71-36704 National Lending Library for Science and Technology, Boston Spa (England).
THE EFFICIENCY OF SINGLE-ROW IMPULSE STAGES ON THE BASIS OF SOVIET TEST DATA
V. D. Pshenichny [1970] 10 p refs Transl. into ENGLISH from Energomashinostroenie (Moscow), v. 16, no. 6, Jun. 1970 p 9-11
(NLL-CE-Trans-5631-(9022.06)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Test data obtained by determining the internal efficiency of single-row impulse stages are presented. The maximum internal efficiency of a single impulse stage is plotted against the parameters of the nozzle cascade and the leakages in the tip section are examined. It is found that the efficiency values obtained in all the experiments are in good agreement if they are reduced to the same test conditions. Author

N71-36705 National Lending Library for Science and Technology, Boston Spa (England).
SLIP FLOW IN ONE DIMENSIONAL GAS CENTRIFUGES
E. Krause 1971 48 p refs Trans. into ENGLISH from Proceedings of DFVLR Colloq. on Flow in Gas Centrifuges, Porz-Wahn, West Germany, 14 May 1970
(NLL-CA-Trans-250-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 3 NLL photocopy coupons

Approximate solutions of the flow equations of compressible binary gas mixtures in one dimensional gas centrifuges are given. The gas mixture is moved through two infinitely long coaxial cylinders. Assuming that the dependence of the transport coefficients on temperature and concentration can be neglected, the solutions are valid for continuum and slip (Gleit) flow. Particular attention is given to the dependence of the separation factor on the peripheral velocity of the inner cyclinder, the wall temperature, and the Knudsen Number. Author

N71-36706 Alabama Univ., University.
ENERGY SEPARATION IN A TWO-DIMENSIONAL CONFINED VORTEX
Charles William Bobbitt (Ph.D. Thesis) 1970 113 p
Avail: Univ. Microfilms Order No. 70-17934

The transient behavior of a perfect gas undergoing two-dimensional vortex motion is studied. Initially, the gas moves with constant tangential speed at the periphery of a circular region. Upon release from this condition, the gas moves to fill the cylindrical region smoothly and tends toward a steady-state condition governed by boundary conditions. The problem is idealized by dividing the flow into two separate regimes. The first is a short duration expansion process in which the gas moves to fill the tube smoothly; the second is the long duration process in which viscosity and conductivity move the gas toward its final state. The flow of the first regime is analyzed from the gaskinetic viewpoint by assuming a collisionless molecular expansion. This expansion, with modifications, provides an initial condition from which a solution to the field equations is programmed. The separation of energy obtained by division of the vortex into core and annulus is given for the collisionless expansion and two modifications. It is shown that one of these divisions gives results which are qualitatively similar to experimental measurements on the Ranque-Hilsch vortex tube. Dissert. Abstr.

N71-36707 North Carolina State Univ., Raleigh.
VORTEX FLOWS OF SECOND ORDER NON-NEWTONIAN LIQUIDS
Clarence Wesley Kitchens, Jr. (Ph.D. Thesis) 1970 148 p
Avail: Univ. Microfilms Order No. 70-18974

A mathematical model representation of a class of non-Newtonian fluids called second-order non-Newtonian liquids is used to investigate the characteristics of non-Newtonian

confined vortex flows. The problem of axisymmetric plane radial and angular steady flow of a second-order liquid within the annulus of two rotating porous concentric cylinders is analyzed. The nonuniqueness of this flow is discussed and solutions for certain classes of flows are obtained using small pertubation techniques. The steady axial flow of a second-order liquid between two rotating porous concentric pipes is also considered. The velocity field and pressure distribution are discussed for both cases. Three-dimensional vortex motions in which the axial velocity is a linear function of the axial coordinate are considered. Limiting solutions for small tangential Reynolds numbers are obtained and a numerical technique is discussed for obtaining solutions for intermediate Reynolds numbers.
Dissert. Abstr.

N71-36708 Colorado State Univ., Fort Collins.
AN ANALYTICAL TREATMENT OF TWO-PHASE FLOW DURING INFILTRATION
Richard Lee Brustkern (Ph.D. Thesis) 1970 116 p
Avail: Univ. Microfilms Order No. 70-20010

Movement of both air phase and the water phase is considered. When the continuity equation, and Darcy's law for each phase are combined with the assumption that capillary pressure can be neglected, an equation involving saturation displacement and an average total velocity, as the unknowns, is obtained. A second equation, involving these two unknowns, is obtained by combining the capillary pressure relationship, and Darcy's law for each phase, and then integrating at a fixed time t. These two relationships are solved in a step-wise manner to yield the saturation profile, and then the infiltration rate, at time t. Soil properties and relationships which are required for the analysis are porosity, intrinsic permeability, relative permeability versus saturation relationships, and the capillary pressure versus saturation relationship. Infiltration rate curves are obtained for a number of situations involving different boundary and/or initial conditions.
Dissert. Abstr.

N71-36709 Stanford Univ., Calif.
LOW REYNOLDS NUMBER SHEAR FLOW PAST A ROTATING CIRCULAR CYLINDER: MOMENTUM AND HEAT TRANSFER
Channing Rex Robertson (Ph.D. Thesis) 1970 254 p
Avail: Univ. Microfilms Order No. 70-18461

The theoretical and experimental determination of heat and mass transfer rates from small particles suspended in a moving fluid was investigated when the particles were allowed to freely rotate and translate. Experimental confirmation that the Nusselt number becomes independent of the shear, for asymptotically large Peclet numbers, and equal to 5.73 is presented. The lower limiting Peclet number beyond which this asymptotic result could be applied with accuracy was determined. A detailed investigation of the low Reynolds number flow pattern past a circular cylinder which is immersed in a constant shear field is also given. A theory was developed for the transport of heat from a stationary cylinder in a uniform shear flow, and then verified by experiment. The importance of free convection, together with the effectiveness of a guard heater system in reducing axial conduction heat losses was assessed.
Dissert. Abstr.

N71-36710 Wisconsin Univ., Madison.
MASS TRANSFER AND HYDRODYNAMICS IN RIPPLING FILMS
David Warren Howard (Ph.D. Thesis) 1970 277 p
Avail: Univ. Microfilms Order No. 70-15896

A theoretical analysis of the often peculiar behavior of laminar liquid films flowing over solid surfaces is presented. Both the flow and diffusional characteristics of such films are considered. Data are divided into the following three parts: (1) a hydrodynamic analysis of rippling films of pure Newtonian liquids, (2) a high Peclet number, boundary layer analysis of mass transfer across the free surface of rippling films for arbitrary velocity and profiles, (3) a linear stability analysis of films under the influence of surface tension gradients. These analyses are found useful both for explaining the observed behavior of these systems and for predictive purposes. They are also useful for pinpointing areas of uncertainty needing further attention, and it is concluded that highest priority should be given to hydrodynamic studies.
Dissert. Abstr.

N71-36711 California Univ., Los Angeles.
A FINITE DIFFERENCE PROCEDURE FOR TURBULENT TUBE FLOWS OF AN EFFECTIVE BINARY GAS MIXTURE WITH NON-EQUILIBRIUM CHEMICAL REACTIONS AND MASS ADDITION
Yi-Chien Wu (Ph.D. Thesis) 1970 256 p
Avail: Univ. Microfilms Order No. 70-19918

A numerical scheme has been developed for the solution of a general turbulent tube flow problem with surface mass transfer and nonequilibrium chemical reactions. The fluid is considered as an ideal gas mixture effective binary diffusion coefficients. The numerical scheme has been developed into a computer program which yields engineering data such as the skin friction coefficient, the wall heat flux, and mass transfer rates. The input data required by the program are very simple: tube diameter, flow rate, initial and boundary conditions. The specific chemical systems considered are nonreacting reversible equilibrium air, the reaction N2O2 yields 2NO2 and the nonequilibrium reversible reaction 2NO2 yields 2NO2 + O2. Computations have been performed to demonstrate the validity and versatility of the computer program. The results show good agreement with available experimental data.
Dissert. Abstr.

N71-36712 Purdue Univ., Lafayette, Ind.
ANALYTICAL PREDICTION OF TURBULENT DISPERSION OF FINITE SIZE PARTICLES
Goodarz Ahmadi (Ph.D. Thesis) 1970 192 p
Avail: Univ. Microfilms Order No. 70-18582

The turbulent dispersion of small rigid spherical particles was studied. Schemes for predicting the turbulent transport coefficient for particles of differing sizes and densities were constructed in three different ways. In the first case a simple kinematic model was considered. The dynamic equation of motion of a small spherical particle in a turbulent field was then studied. In the third case, the dynamic equation was treated as a stochastic differential equation. The normalized Schmidt number was determined for all cases. An increase in mass diffusivity with particle size and a decrease in mass diffusivity with an increase in particle density and turbulent microscale was predicted. These results were shown to agree with the majority of the experimental data available.
Dissert. Abstr.

N71-36713 Washington Univ., St. Louis, Mo.
CONFORMAL SOLUTION THEORY FOR THE MIXTURES OF SIMPLE LIQUIDS
Jienn-Jeng Houng (Ph.D. Thesis) 1970 168 p
Avail: Univ. Microfilms Order No. 70-19949

The conformal solution theory of Brown which has been modified by Wheeler and by Calvin has been applied to the excess properties F sup E, H sup E, V sup E of mixtures of the simple liquids Ar, Kr, N2, O2, CO, CH4, and CF4. The energy and size conformal parameters of the pure components were calculated by applying the corresponding states principle to the configurational enthalpies and the molar volumes of the pure components with methane as the common reference substance. The mixture conformal parameters were obtained by fitting F sup E and V sup E data for the mixture. Several averaging methods were investigated to relate the mixture parameters to the pure component values. Brown's averaging method appears best when m,n = 3,4. The harmonic mean was better than the geometric and arithmetical means but had to be multiplied by correction terms for the energy and size parameters respectively.
Author

N71-36714 California Univ., Berkeley.
THE EFFECT OF CONDENSATION IN THE BOUNDARY LAYER ON MASS TRANSFER FROM A ROTATING DISK
Ronald Paul Omberg (Ph.D. Thesis) 1969 192 p
Avail: Univ. Microfilms Order No. 70-17634

The vaporization rate of a hot solid into a cold gas may be increased above the diffusion-limited value if condensation occurs in the boundary layer. This phenomenon was analyzed by combining the microscopic balance equations of nucleation kinetics with the boundary layer conservation equations. The equations were derived for rotating disk hydrodynamics and calculations made for the vaporization of iron into cold argon. The vaporization rate of the rotating disk was computed, and the structure of the nucleation zone in the boundary layer surrounding the disk was examined. The vaporization rate was measured experimentally for a hot rotating disk of chromium vaporizing into a cold helium environment. The data showed that condensation enhancement of the vaporization rate does in fact occur. The measured rates were compared with the theoretical rates calculated with the above model. The theoretical rates were always considerably lower than the measured rates.
Dissert. Abstr.

N71-36715 Rochester Univ., N.Y.
AN EXPERIMENTAL INVESTIGATION OF FINITE AMPLITUDE OSCILLATIONS IN A CLOSED TUBE AT RESONANCE
Donald Burgoyne Cruikshank (Ph.D. Thesis) 1970 163 p
Avail: Univ. Microfilms Order No. 70-17870

An experimental apparatus, consisting of a 5 ft 8 in. cylindrical, air filled pipe, capped at one end, and fitted with a movable piston at the other end, was constructed to measure pressure waveforms. The piston is driven sinusoidally by an electrodynamic shaker, and pressure waveform measurements are made with a microphone at the rigidly capped end of the pipe. A hybrid computer system is used to calculate Chester's theoretical waveforms and compare them with experimental waveforms. It is shown that, for this experimental system, a high piston displacement amplitude is required to establish an experimental condition consistent with the approximations of Chester's analysis. Comparisons between theory and experiment are made at the resonance frequency and at two frequencies bracketing resonance for three successively higher piston displacement amplitudes. Good qualitative agreement between the shapes of experimental and theoretical waveforms is found at high piston displacement amplitude.
Dissert. Abstr.

N71-36716 Carnegie-Mellon Univ., Pittsburgh, Pa.
TURBULENT MIXING OF SUPERSONIC JETS WITH HEATED QUIESCENT AIR
Richard Herbert Larson (Ph.D. Thesis) 1970 326 p
Avail: Univ. Microfilms Order No. 70-18027

The mixing phenomena of supersonic air jets exhausting into heated surrounding air was both experimentally and theoretically investigated. Measurements of the impact pressure and stagnation temperature were made primarily in the developed region of Mach 1.0 to 2.4 jets exhausting into air heated up to 1500 R. Generally, developed temperature and velocity profiles were found to exist beyond 15 nozzle diameters for Mach 1.0, 20 for Mach 1.4, 25 for Mach 1.8, 30 for Mach 2.0, and 40 for Mach 2.4. The axial velocity decay, axial temperature decay, jet spreading, and entrainment were found to decrease as the temperature difference between the surrounding air and the jet increased. Integral momentum and energy conservation equations were found to yield excellent correlations for the experimental data on the jet axis for both compressible and incompressible limit.
Dissert. Abstr.

N71-37003# State Univ. of New York at Buffalo. Div. of Interdisciplinary Studies and Research.
DIFFRACTION OF A PLANE ACOUSTIC PULSE BY A FREE ORTHOGONAL TRIHEDRON (THREE-DIMENSIONAL CORNER)
Richard P. Shaw and Daniel F. Courtine *In* Atlantic Oceanog. and Meteorol. Labs. Collected Reprints, 1969, vol. 2 Sep. 1970 3 p Repr. from J. Acoust. Soc. Amer., v. 46, no. 5, 1969 p 1382-1384 Sponsored in part by ONR (See N71-36973 23-20)
Avail: SOD $3.75

N71-37003# State Univ. of New York at Buffalo. Div. of Interdisciplinary Studies and Research.
TRANSMISSION OF PLANE WAVES THROUGH LAYERED LINEAR VISCOELASTIC MEDIA
R. P. Shaw and P. Sugi *In* Atlantic Oceanog. and Meteorol. Labs. Collected Reprints, 1969, vol 2 Sep. 1970 6 p refs Repr. from J. Acoust. Soc. Amer., v. 46, no. 3, 1969 p 649-654 Sponsored in part by ONR (See N71-36973 23-20)
Avail: SOD $3.75

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N71-36717*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A DETAILED GRAVIMETRIC GEOID FOR THE UNITED STATES
William E. Strange (Computer Sci. Corp., Falls Church, Va.), Samir F. Vincent (Computer Sci. Corp., Falls Church, Va.), Richard H. Berry (Computer Sci. Corp., Falls Church, Va.), and James G. Marsh Jun. 1971 39 p refs
(NASA-TM-X-65691; X-552-71-219) Avail: NTIS CSCL 04A

A detailed gravimetric geoid for the United States, which has been computed from a combination of satellite derived gravity data and local gravimetric measurements, is presented. The detailed geoid is shown to possess a precision of plus or minus 2 meters rms. Comparisons of the detailed geoid with results of Rapp, Fischer, and Rice are presented.
Author

N71-36718*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON EMPIRICAL MODELS OF THE UPPER ATMOSPHERE IN THE POLAR REGIONS
Peter W. Blum and Isadore Harris Sep. 1971 17 p refs
(NASA-TM-X-65697; X-641-71-367) Avail: NTIS CSCL 04A

The expression for the exospheric temperature in Jacchia's static diffusion models of the upper atmosphere has a discontinuous gradient at the poles. Therefore it cannot describe the true state of the upper atmosphere in the polar regions. Furthermore, it cannot be used to calculate quantities that depend on the derivative of the exospheric temperature, or the density, like pressure gradients, horizontal forces or horizontal heat fluxes. A modified expression for the exospheric temperature is suggested. This modification yields variables of state of the upper atmosphere that deviate little Jacchia's values, but it has continuous gradient at the poles and is therefore more suitable for treating dynamical problems like the global wind pattern.
Author

N71-36719*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A DIFFUSION MODEL FOR THE PHASE DELAY BETWEEN THERMOSPHERE DENSITY AND TEMPERATURE
H. G. Mayr and H. Volland (Bonn Univ.) Aug. 1971 28 p refs Submitted for publication
(NASA-TM-X-65694; X-621-71-330) Avail: NTIS CSCL 04A

Considering a two-dimensional time dependent model in

which the thermosphere dynamics are excited by the UV heat input within the thermosphere, it is shown that the wind circulation-drag-diffusion induced variations in the diurnal component of atomic oxygen dominate over its temperature induced variations up to 200 km. The assumption of diffusive equilibrium is therefore in general not valid for O within the lower thermosphere. The effect of the diurnal wind circulation tends to remove O from the day to night side of the earth with the consequence that (1) the diurnal variations in the O/N2 and O/O2 ratios are damped by about 20% thus contributing to the maintenance of the nighttime F2 region and (2) the maximum in the diurnal variation of O is shifted by one to two hours away from the temperature maximum toward noon thus explaining the temperature-density time lag at thermospheric heights above 200 km where O becomes the major constituent. The mass redistribution due to circulation, which accounts for significant density-temperature time delays within the N2 region of the lower thermosphere, is essentially extended into the upper thermosphere through the diffusion (drag) process which affects most significantly the atmospheric constituents with lower masses. Author

N71-36720*# Aeronautical Research Associates of Princeton, Inc., N.J.
COMPUTING DISPERSAL OF ATMOSPHERIC POLLUTANTS NEAR AIRPORTS
Coleman duP. Donaldson and Glenn R. Hilst Jul. 1971 36 p refs
(Contract NAS1-10192)
(NASA-CR-111962; ARAP-162) Avail: NTIS CSCL 04A

The basic rationale of invariant modeling is demonstrated and verified in specifying the structure of atmospheric turbulence near the ground. A model capable of predicting the dispersal of inert airborne pollutants emanating from arbitrary source configurations was constructed and tested. This model depends upon the turbulence model for inputs of turbulence structure and, when the source configuration is specified, predicts the distribution of pollutant concentration downstream. E.M.C.

N71-36721*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A UNIFIED SET OF TRACKING STATION COORDINATES DERIVED FROM GEODETIC SATELLITE TRACKING DATA
J. G. Marsh, B. C. Douglas, and S. M. Klosko Jul. 1971 287 p refs
(NASA-TM-X-65707; X-553-71-370) Avail: NTIS CSCL 08E

A unified set of coordinates for over 200 optical, laser, and electronic tracking sites are given on a geocentric reference system. The transformations from local survey coordinates to the geocentric system were determined from the local survey and center of mass coordinates of about 50 tracking sites dynamically estimated from optical, laser, and Goddard range and range rate observations of geos 1 and 2. About 50,000 optical observations taken by STADAN and SPEOPT cameras, Smithsonian Astrophysical Observatory Baker-Nunn cameras, and international cameras were used. In addition, about 200,000 GRARR and laser observations were employed to determine the positions of four GRARR stations and three NASA lasers. The total position error of the dynamically estimated control sites is less than 10 m. Transformed coordinates are of comparable accuracy in most cases because of the proximity of transformed sites to dynamically estimated control sites. Local Survey data for all stations are included for reference. Author

N71-36722# International Association of Geodesy, Paris (France). Permanent Commission on Earth Tides.
EARTH TIDES NEWS BULLETIN, NO. 57 [MAREES TERRESTRES BULLETIN D'INFORMATION, NO. 57]
Paul Melchior, ed. (Belgian Roy. Obs.) 31 May 1970 48 p refs Transl. into FRENCH from Dokl. Simpozium Leningrad (Kiev), 1968; Fiz. Zemli, 1965 p 75-79; Astron. Tsirkulyar (Kiev), no. 393, 20 Nov. 1966 and Acad. of Sci. of the Ukr. SSR rept. In FRENCH
Avail: NTIS

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N71-36723# International Association of Geodesy, Paris (France). Permanent Commission on Earth Tides.
RESULTS OF GROUP OBSERVATIONS OF THE EARTH SURFACE AT A STATION OPPOSITE THE MOSCOW REGION [RESULTATS DES OBSERVATIONS DE GROUPES DES INCLINAISONS DE LA SURFACE DE LA TERRE A LA STATION OPPOSEE A LA REGION DE MOSCOU]
L. A. Latinina (Acad. of Sci. of the Ukr. SSR) et al *In its* Earth Tides News Bull., No. 57 31 May 1970 p 2720-2728 In FRENCH (See N71-36722 23-13)
Avail: NTIS

A photographic recording clinometer is used to determine the minimum inclination angle of the earth's surface. The measurements were made in groups-NS, EW, and N 45 deg E. and comparisons were made of the results. There is a variation of about 0 sec 2 to 0 sec. 5 in the groups. E.H.W.

N71-36724# International Association of Geodesy, Paris (France). Permanent Commission on Earth Tides.
ON CLINOMETRIC OBSERVATIONS IN SOUNDING [SUR LES OBSERVATIONS CLINOMETRIQUES DANS LES SONDAGES]
A. E. Ostrovskii (Acad. of Sci. of the Ukr. SSR) et al *In its* Earth Tides News Bull., No. 57 31 May 1970 p 2729-2733 refs In FRENCH (See N71-36722 23-13)
Avail: NTIS

A detailed examination of the results of observations made in sounding wells, and a schematic description of the two types of wells used are given. The sounding areas were located in the Ukraine and Moscow. Transl. by E.H.W.

N71-36725# International Association of Geodesy, Paris (France). Permanent Commission on Earth Tides.
ON THE AMPLITUDE VARIATIONS OF FREE DIURNAL NUTATION OF THE EARTH [SUR LES VARIATIONS DE L'AMPLITUDE DE LA NUTATION LIBRE DIURNE DE LA TERRE]
N. A. Popov (Acad. of Sci. of the Ukr. SSR) et al *In its* Earth Tides News Bull., No. 57 31 May 1970 p 2734-2740 refs In FRENCH (See N71-36722 23-13)

Avail: NTIS

To improve models of the internal structure of the earth, astronomical observations of the diurnal earth nutation and perturbation mechanisms were studied. Frequency oscillations, spectral, and latitude phenomena were also determined. E.H.W.

N71-36726# International Association of Geodesy, Paris (France). Permanent Commission on Earth Tides.
FUNDAMENTAL RESULTS OF THE ANALYSIS OF CLINOMETRIC OBSERVATIONS OF THE ENGELHART ASTRONOMICAL OBSERVATORY [RESULTATS FONDAMENTAUX DE L'ANALYSE DES OBSERVATIONS CLINOMETRIQUES A L'OBSERVATOIRE ASTRONOMIQUE ENGELHARDT]
Y. A. Ourssaine *In its* Earth Tides News Bull., No. 57 31 May 1970 p 2741-2749 refs In FRENCH (See N71-36722 23-13)
Avail: NTIS

The results of a harmonic analysis of 1960 and 1968 observations, the retreating of 1952 to 1954 observations, and the enlargement of fundamental results derived for inclinations of the earth in 1965 and 1968, are presented. Observations were made of NS and EW components. Transl. by E.H.W.

N71-36727# International Association of Geodesy, Paris (France). Permanent Commission of Earth Tides.
LABORATORY OF EARTH TIDES AT TBILISSI [LABORATOIRE DES MAREES TERRESTRES A TBILISSI]
B. K. Balavadze (Acad. of Sci. of the Georgian SSR) et al *In its* Earth Tides News Bull., No. 57 31 May 1970 p 2750-2751 In FRENCH (See N71-36722 23-13)
Avail: NTIS

An underground laborstory for detecting and measuring variations in earth tide intensity was constructed. The facility was equiped with recording instruments and computers to store and analyze the data. E.H.W.

N71-36728# International Association of Geodesy, Paris (France). Permanent Commission on Earth Tides.
INCLINATION OF THE EARTH SURFACE AFTER THE TALGAR OBSERVATIONS [INCLINAISON DE LA SURFACE DE LA TERRE D'APRES LES OBSERVATIONS DE TALGAR]
S. M. Fandiouchina (Acad. of Sci. of the Ukr. SSR) *In its* Earth Tides News Bull., No. 57 31 May 1970 p 2753-2762 In FRENCH (See N71-36722 23-13)
Avail: NTIS

Variations in a series of elastic tide variations made from 1966 to 1969 at the Talgar seismic station are compared to those obtained in 1964 and 1966 by the same station. Results indicated variations were caused by the method, instrumentation, and the location of the instrument at the time of measurement. E.H.W.

N71-36729# International Association of Geodesy, Paris (France). Permanent Commission on Earth Tides.
INCLINATION OBSERVATIONS BY THE ENGELHART ASTRONOMICAL OBSERVATORY [LES OBSERVATIONS DES INCLINAISONS A L'OBSERVATOIRE ASTRONOMIQUE ENGELHARDT]
Y. A. Ourssaine (Acad. of Sci. of the Ukr. SSR) *In its* Earth Tides News Bull., No. 57 31 May 1970 p 2763-2769 In FRENCH (See N71-36722 23-13)
Avail: NTIS

Observations made between 1965 and 1968 of the NS and EW components were reviewed to determine instrument drift in recording earth surface inclinations. The drift was observed to be 0 sec 6 to 0 sec 4 in the NS and 0 sec 3 in the EW. Transl. by E.H.W.

N71-36730# International Association of Geodesy, Paris (France). Permanent Commission on Earth Tides.
OBSERVATIONS ON THE DEFORMATION OF EARTH TIDES WITH THE AID OF THE TBILISSI HORIZONTAL EXTENSOMETER [OBSERVATIONS SUR LES DEFORMATIONS DE MAREES TERRESTRES A L'AIDE D'UN EXTENSOMETRE HORIZONTAL A TBILISSI]
B. K. Balavadze (Acad. of Sci. of the Georgian SSR) et al *In its* Earth Tides News Bull., No. 57 31 May 1970 p 2770-2777 refs In FRENCH (See N71-36722 23-13)
Avail: NTIS

Deformation of the earth's surface caused by earth tide inclinations are measured using a horizontal extensometer. The effects of air temperature, annual variations, and seismic oscillations over long periods are considered. E.H.W.

N71-36731# International Association of Geodesy, Paris (France). Permanent Commission on Earth Tides.
DETERMINATION OF THE PRINCIPAL TERMS OF NUTATION AFTER LATITUDE OBSERVATIONS ARE GIVEN [DETERMINATION DES TERMES PRINCIPAUX DE LA NUTATION D'APRES LES DONNEES DES OBSERVATIONS DE LATITUDE]
V. K. Teredy *In its* Earth Tides News Bull., No. 57 31 May 1970 p 2778-2780 refs In FRENCH (See N71-36722 23-13)
Avail: NTIS

Observations from 1900 to 1940 are analyzed in an effort to provide constant nutation values of the earth's surface. Corrections were determined for nutation values and coefficients from latitude observations. Day and night observations were considered in the analysis. E.H.W.

N71-36732# Cranfield Inst. of Technology (England). School of Mechanical Engineering.
THE DECAY OF HIGH INTENSITY ISOTROPIC TURBULENCE
D. R. Ballal Jun. 1971 27 p refs
(Rept-6) Avail: NTIS

An experimental investigation was conducted to study the decay of high intensity near-isotropic turbulence behind three different perforated plates. The study covered a useful practical range of Reynolds number of turbulence between 120 to 20. The grid Reynolds number was varied sufficiently to span the critical Reynolds number for the plates. Measurements of pressure loss, intensity, dissipation scale, and integral scale were made over this wide range. It was found that at the higher values of Reynolds number of turbulence, the energy spectrum agrees with Kolmogoroff's law over a limited wave number range. This implies that the rate of decay depends upon the initial energy spectrum. The energy-containing eddies have self preserving characteristics during the decay and the Loitsianskii's invariant condition probably exists. The integral scale of turbulence was found to be a function of Reynolds number, but no definite trends were established, due to the limitations of the experimental apparatus. Author

N71-36733# Louisiana Dept. of Highways. Research and Development Section.
AIR POLLUTION FROM HOT MIX PLANTS
W. T. Burt, III and Bruce J. Gusho Oct. 1970 50 p refs
(PB-199355; RR-50) Avail: NTIS CSCL 13B

For Louisiana it was found that no plant consistently operates within the regulations established by the Louisiana Air Control Commission while maintaining reasonable production. All plants could improve their particular emissions through more care of and concern for their present equipment and procedures. Almost half of the pollution caused by most plants originates from sources other than the stack. Air pollution from these secondary sources could be reduced by the use of water scrubbers or bag collectors. Author (GRA)

N71-36734# National Oceanic and Atmospheric Administration, Rockville, Md.
UNITED STATES EARTHQUAKES, 1969
Carl A. von Hake and William K. Cloud Jul. 1971 85 p refs
Avail: SOD $1.00

A summary of earthquakes occurring in the US during 1969 is presented. The modified Mercalli intensity scale used for reporting earthquake intensities is described. Summaries of worldwide earthquakes of magnitude greater than 6.75, fluctuations in well-water levels, and strong-motion seismographs are also included. F.O.S.

N71-36735# Joint Publications Research Service, Washington, D.C.
PRESERVATION OF THE "LANDSCAPE SPHERE"
Fatey Yakovlevevich Shipunov 15 Sep. 1971 28 p refs
Transl. into ENGLISH from Priroda (Moscow), no. 5, 1971 p 18-29
(JPRS-54059) Avail: NTIS

The landscape sphere of the earth is discussed along with it's dense atmospheric layers. A discussion is presented of the forces acting on the landscape sphere which maintain it for the support of life. The external radiation shields for protection from extraterrestrial radiation; the internal shields for protection from high abyssal temperatures in the earth and from gases exuded from the mantle; and the biogeochemical function of living matter providing renewal of the oxygen-nitrogen atmosphere are included. Effects of changes in the biosphere are indicated. The anthropogenic processes are also covered as well as possible scientific regulations. J.M.

N71-36736# Argonne National Lab., Ill.
WORK PLAN FOR CONTINUATION OF THE PROJECT REDUCTION OF ATMOSPHERIC POLLUTION BY THE APPLICATION OF FLUIDIZED BED COMBUSTION
A. A. Jonke, G. J. Vogel, L. J. Anastasia, and R. L. Jarry Apr. 1971 38 p refs
(Contract W-31-109-eng-38)
(ANL/ES-CEN-1003) Avail: NTIS

A development program is outlined for a continuing study of the lowering and control of the level of pollutants (SO_2, NO, and particulate) in flue gas from the combustion of fossile fuels, using the fluidized-beds to which limestone is added. The major emphasis of the next phase of work will be on combustion at pressures up to 10 atm and regeneration of the sulfated lime under pressure. Fluidized-bed combustors will be operated in the one- and two-stage modes to investigate effects on NOx and sulfur emissions. The program will include laboratory- and bench-scale work aimed at elucidating mechanisms important to sulfur oxide and nitrogen oxide control. Author

N71-36737# Technische Hochschule Carolo Wilhelmina, Brunswick (West Germany).
SEISMIC WAVES IN NONHOMOGENEOUS MEDIA [SEISMISCHE WELLEN IN INHOMOGENEN MEDIEN]
Hans-Peter Harjes (Ph.D. Thesis) 1971 84 p refs In GERMAN
Avail: NTIS

An integral formulation for the wave equation is used to calculate the reflectivities of nonhomogeneous media having differing depth distributions of their dynamical parameters. The effects of density, compressibility, phase velocity, frequency and angle of incidence on the reflections of linear waves are studied separately. It is shown that thin nonhomogeneous inserts in a homogenous medium provide for strong reflections in a limited frequency region; position and shape of this frequency maximum and its minor maxima depend on the behavior of the continuum parameters. Periodic fluctuations reflect mainly deep frequencies. A sedimentation model proves that effects of density changes remain minimal as long as compressibility changes too and the formation of a velocity channel is avoided. A Fourier analysis is necessary to transform seismic waves to a time scale.
Transl. by G.G.

N71-36738# Technische Hochschule Munchen (West Germany). Fakultaet fuer Maschinenwesen und Elektrotechnik.
A NEW INVESTIGATION FOR DETERMINING THE VISUAL RANGE IN THE ATMOSPHERE [EIN NEUES VERFAHREN ZUR BESTIMMUNG DER SICHTWEITE IN DER ATMOSPHERE]
Manfred Lang (Ph.D. Thesis) [1971] 19 p In GERMAN
Avail: NTIS

Backscattering of a light impulse propagating through the atmosphere is used to determine the optical extinction coefficient and thus the visibility factor. This method provides information for a visual field of 50 to 1500 m on the position of inhomogeneities, visual range before, in, and after the inhomogeneity, and the median visual range at certain intervals through the shape of the extinction coefficient curve.
Transl. by G.G.

N71-36739# Groupe de Recherches Ionospheriques, Paris (France).
IONOSPHERIC DRIFTS IN THE E REGION. OBSERVATIONS MADE AT GARCHY IN 1969 AND 1970 USING THE FADINGS METHOD [LES VENTS IONOSPHERIQUES DE LA REGION E. OBSERVATIONS FAITES A GARCHY, PAR LA METHODE DES FADINGS, EN 1969 ET 1970]
A. Haubert, J. Tabbagh, and G. Doyen Jun. 1971 33 p refs In FRENCH
(GRI/NTP/87; GRI/NTP/87) Avail: NTIS

Statistical results are presented of the ionospheric drift of the E region during 1969 and 1970. The statistical results obtained during 1968 and 1969 are also completed. ESRO

N71-36740# Academy of Sciences (USSR), Moscow. Inst. for Space Research.
AURORAL PROTONS MEASURED ON COSMOS-261 AND A SUBSTORM CONCEPT
Y. I. Galperin, V. A. Gladyshev, A. V. Gurevich, A. K. Kuzmin, and Y. N. Ponomarev 1970 43 p refs In RUSSIAN and ENGLISH
(D-22) Avail: NTIS

A comparison between Cosmos 261 auroral proton spectra and angular distributions (1968-1969) with other measurements was made, and it was concluded that the characteristic particle energy (10 KeV) may be found in all processes connected with the quasitrapped component of auroral particles. Based on this conclusion, a resonance concept is suggested for the substorm generation in the magnetosphere. ESRO

N71-36741# Academy of Sciences (USSR), Moscow. Inst. for Space Research.
PITCH-DISTRIBUTION OF PROTONS PRECIPITATING FROM THE AURORAE RADIATION REGION IN THE RANGE OF HUNDREDS keV
R. A. Kovrazhkin 1970 28 p refs In ENGLISH and RUSSIAN
(D-26) Avail: NTIS

The results of medium energy proton measurements carried out on the Cosmos 261 satellite using a scintillation detector with four different energy ranges from 300 keV to 9 MeV are described. The pitch distributions of protons are given for different intervals of invariant latitudes during the magnetically quiet period at the end of 1968 in the Northern Hemisphere at altitudes of 220 to 240 km. ESRO

N71-36742# Academy of Sciences (USSR), Moscow. Inst. for Space Research.
COORDINATED MEASUREMENTS OF THE IONOSPHERIC EFFECTS OF THE CHROMOSPHERIC FLARE ON 27 DECEMBER 1968 FROM THE COSMOS-261 SATELLITE AND GROUND OBSERVATORIES
A. Best, G. Entzian, Y. I. Galperin, A. Grafe, R. Knuth et al 1970 20 p refs
(D-23) Avail: NTIS

During the experiment conducted by the Cosmos-261 satellite and ground geophysical observations of the socialist

countries (20th December 1968-12th February 1969). measurements were recorded during the chromospheric flare on December 27th, 1968. Ionospheric measurements from the observatories during the flare are combined with the Cosmos photoelectron intensity measurements. ESRO

N71-36743# Academy of Sciences (USSR), Moscow. Inst. for Space Research.
THE HEATING FUNCTION OF THERMOSPHERE BY SOLAR RADIATION IN SCHUMANN-RUNGE CONTINUUM
M. N. Izakov 1970 27 p refs Presented at the 8th COSPAR Session, Leningrad, May 1970
(D-14) Avail: NTIS

Thermospheric heat sources due to solar radiation are calculated for different altitudes and possible distributions of atmospheric particle density, in the spectral range 1300-1800 Angstrom. Efficiency of the conversion of absorbed radiation into heat is taken into account depending on wavelength and particle concentrations, in presence of oxygen photodissociation, excitation of metastable oxygen atoms, and quenching. ESRO

N71-36744# Academy of Sciences (USSR), Moscow. Inst. for Space Research.
SOME RESULTS OF DETERMINATION OF DIURNAL AND SEMI-ANNUAL VARIATIONS IN THE UPPER ATMOSPHERE DENSITY FROM THE DATA OF A DECELERATION OF COSMOS SATELLITES
M. Voiskovsky, B. V. Kugaenko, V. M. Synitsyn, and P. E. Elyasberg 1970 28 p refs In RUSSIAN and ENGLISH
(D-18) Avail: NTIS

The determination of long-term variations of the atmospheric density at 200-300 km altitude from Cosmos satellite drag data is discussed. The data are analyzed for the years 1964 - 1969, which cover periods of minimum, increase, and maximum solar activity in a continuous cycle. Diurnal and semi-annual variations are studied at different levels of solar activity, and are compared with the CIRA-65 model. ESRO

N71-36745# Joint Publications Research Service, Washington, D.C.
SOME RESULTS OF SPECTROPHOTOMETRY OF THE EARTH FROM THE SOYUZ 7 SPACECRAFT
K. Ya. Kondratyev et al 14 Sep. 1971 6 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 195, no. 5, 1970 p 1084-1087
(JPRS-54047) Avail: NTIS

Spectrophotometry of the earth's twilight atmosphere and of the underlying surfaces was conducted from the Soyuz 7 spacecraft with the aid of a modified manual spectrograph RSS-2. Comparison of the results with the data from a similar experiment conducted during the flight of the Soyuz 5 spacecraft indicates that the qualitative behavior of the monochromatic curves for the halo's brightness is identical in both experiments. Spectral data were also obtained of natural surfaces such as: (1) solid cloud cover; (2) thin cloud cover; (3) rocky desert; and (4) shadow from cloud cover. A.L.

N71-36746# Kansas Univ., Lawrence. Center for Research, Inc.
PROJECT THEMIS: A CENTER FOR REMOTE SENSING Semiannual Technical Report, Sep. 1970 - Mar. 1971
F. T. Ulaby Mar. 1971 190 p refs
(Contract DAAK02-68-C-0089; Proj. Themis)
(AD-726966; CRES-TR-133-23; ETL-CR-71-7; stpr-7) Avail: NTIS CSCL 17/9

The report summarizes the technical progress under the subject contract on a broad interdisciplinary effort for the improvement of user utility of remotely sensed data. This effort involves theoretical work, sensor development, processing and display, and data analysis for specific user application. A number of technical reports and memoranda describing work underway are attached. Author (GRA)

N71-36747# Arctic Inst. of North America, Washington, D.C.
INFRARED RADIANT TEMPERATURES IN THE ALPINE/PERIGLACIAL ENVIRONMENT AS RELATED TO THERMAL REMOTE SENSING.
Ray Leonard Lougeay (Ph.D. Thesis - Mich. Univ., Ann Arbor) Jul. 1971 123 p refs
(Contract DAHC04-67-C-0047)
(AD-726958; AINA-RP-80) Avail: NTIS CSCL 08/12

Observations were conducted in the St. Elias Mountains, Yukon Territory, Canada to determine some aspects of the applicability of thermal remote sensing in the alpine/periglacial environment. Techniques of ground truth observations were tested by which a researcher might determine the usefulness of infrared scanning to his study without the financial investment of airborne remote sensing on a trial-and-error basis. Also, an attempt was made to determine the environmental controls upon radiant temperature by monitoring changing patterns of radiant temperature relative to changing meteorologic conditions. Observations of both actual and thermal infrared radiant temperatures were made over various environmental surfaces in the alpine/periglacial environment. These surfaces included various types of ice-cored moraine, glacial ice, and morainic outwash at the terminal margins of a large valley glacier. Author (GRA)

N71-36748# Air Force Cambridge Research Labs., Bedford, Mass.
A REMOTE-SENSING INVESTIGATION OF FOUR MOJAVE PLAYAS. ENVIRONMENTAL RESEARCH PAPERS
Carlton E. Molineux, Emmanuel E. Bliamptis, and James T. Neal 16 Apr. 1971 73 p refs
(AD-727031; AFCRL-71-0235; AFCRL-ERP-352) Avail: NTIS CSCL 08/6

Dry lakebeds (playas) in the Mojave Desert are often hard and flat enough to serve as natural landing areas for aircraft. However, the surface physical properties of moisture, strength, and microrelief can vary with seasonal or local conditions. It is desirable to develop methods for determining and monitoring these properties and their variations. Airborne remote sensing enables collection of data on the reflectance, temperature, and emissivity of these surfaces that can be correlated with soil parameters. Four playas in the Mojave Desert that have a variety of surface properties were investigated. Airborne spectrophotography and thermal infrared imagery were obtained by overflights. Ground photometry and measurements of surface properties were obtained. Moisture-sensitive dyes were applied to one lakebed surface to evaluate the feasibility of monitoring its dryness through color changes apparent on the aerial photography. The report describes the results of the remote-sensing investigations and the correlation of photographic and imagery interpretation with actual surface conditions. Author (GRA)

N71-36749*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A SEARCH FOR RESIDUAL MAGNETISM ALONG A TORNADO PATH
Robert C. Costen and Clifford L. Fricke Washington Oct. 1971 26 p refs
(NASA-TN-D-6475; L-7705) Avail: NTIS CSCL 04A

A search for residual magnetism was made along the damage path of a strong tornado that passed through a residential section of Hazlehurst, Mississippi, on January 23, 1969. Over 3000 gauss-meter readings were taken on rainheads in 24 frame buildings at various points on both sides of the damage path, but no evidence of residual magnetism attributable to the tornado was found. A statistical analysis of the data from seven of the buildings showed that an upper bound on possible axial dc electric current in the tornado was 3800 amperes at touchdown and 6100 amperes during its most intense phase. Residual-magnetism measurements also indicated that transient electric currents of about 135 and 300 amperes had occurred in ground wires connected to the electric-meter bases on two

buildings. This finding suggests that residual-magnetism measurements on nails may be useful for detecting possible magnetic fields from ball lightning and other sporadic electrical phenomena, since no prior instrumentation is required. Author

N71-36750# Naval Undersea Research and Development Center, San Diego, Calif.
ACOUSTIC RELAXATION IN UNCONSOLIDATED MARINE SEDIMENTS Research and Development Technical Publication, Jan. - Dec. 1970
L. R. B. Duykers Jun. 1971 33 p refs
(AD-726705; NUC-TP-233) Avail: NTIS CSCL 08/10

Acoustic relaxation theory for viscoelastic media provides for sound propagation in unconsolidated marine sediments. For the frequency range of 14 to 200 khz, dispersion for compressional wave and shear wave velocity is negligible for all practical purposes. But sound absorption shows significant changes. Author

N71-36751# Texas Univ., Austin. Applied Research Labs.
INVESTIGATION OF GAS IN BOTTOM SEDIMENTS Final Report, 1 Jan. - 31 Dec. 1969
Aubrey L. Anderson, Robert J. Harwood, and Robert T. Lovelace 7 Jun. 1971 42 p refs
(Contract Nonr-3579(01))
(AD-726712; ARL-TR-70-28) Avail: NTIS CSCL 08/10

The occurrence of gas bubbles in sediments has been noted in several contexts in the past, particularly in the field of acoustics, where bubbles cause aberrations in the predicted behavior of sound waves. The presence of bubbles in sediments can be predicted from a theoretical model of the bottom sediment chemical system. The model developed in this investigation suggests that bubbles will form in any sediment that contains organic materials, as a result of anaerobic bacterial activity. Thus, most naturally occuring sediments are likely to contain bubbles. Several steps have been made toward testing the model quantitatively, including the development of methods for collecting and analyzing uncontaminated samples of free and dissolved gas. Preliminary results from tests of these methods in general confirm the model, predictions of gas bubble occurrence. Measurements of acoustical attenuation (frequency range 40 to 80 KHZ) in gas-bearing sediments ranged from 7 to 30 DB/ft. Author

N71-36782# National Physical Lab., New Delhi (India).
IONOSPHERIC DATA, DECEMBER 1969
Dec. 1969 78 p
(RTRC-A175) Avail: NTIS

Tables of hourly values of propagation data for the E and F regions are presented for several stations in India. These include critical frequency, minimum virtual height, F-min, and M(3000)F2 data. Author

N71-36783# National Physical Lab., New Delhi (India).
IONOSPHERIC DATA, NOVEMBER 1969
Nov. 1969 78 p
(RTRC-A174) Avail: NTIS

Tables of hourly values of propagation data for the E and F regions are presented for several stations in India. These include critical frequency, virtual height, F-min, and M(3000)F2 data. Author

N71-36784# Addis Translations International, Woodside, Calif.
SEISMIC VIBRATIONS DUE TO EARTHQUAKES AND EXPLOSIONS
F. F. Aptikaev 1969 121 p refs Transl. into ENGLISH of the book "Seismicheskie Kolebaniya pri Zemletryaseniyakh i Vzryvakh" Moscow, Izdatelstvo Nauka, 1969 121 p Prepared for California Univ.
(UCRL-Trans-10436) Avail: NTIS

The energy release problem for both earthquakes and explosions is examined using both seismic data measured in the USSR and data published in the U. S., particularly data on the seismic aspects of the Plowshare Program. The various topics discussed include: description of seismic sources; the seismic energy of an explosion; wave characteristics and propagation from seismic events; and the application of the theory of similarity to the study of seismic vibrations. NSA

N71-36785*# North American Rockwell Corp., Anaheim, Calif. Autonetics Div.
OPTICAL PROPAGATION MEASUREMENTS AT EMERSON LAKE, 1968
Gus E. Mevers, M. P. Keister, Jr., and David L. Fried Washington NASA Sep. 1971 231 p refs
(Contract NAS1-7705)
(NASA-CR-1733; C8-3042/401) Avail: NTIS CSCL 04A

A series of carefully controlled measurements concerned with optical propagation in an inhomogenous atmosphere were conducted at Emerson Lake (dry), Twenty-Nine Palms, California, to test the validity or range of validity of the optical propagation theory. Measurements were made of atmospheric-produced scintillation and wavefront distortion for wavelengths of 0.5 to 10.6 microns and over ranges of 0.5 to 5.0 km. The results substantiate the predictions of theory for 0.5 to 1.15 micron wavelengths over short range transmission, but give a positive indication, in the form of a saturation of scintillation, of its failure at long ranges and indicate that the saturation level of scintillation is wavelength dependent and that a functional relationship exists between predicted and measured scintillation for a condition of saturation. Optical and temperature measurements of the optical strength of turbulence were made for comparison of the two techniques in making scintillation predictions. The results indicate that the optical method provides more useable results, but that it may be possible, with modifications in the data reduction procedure, to obtain equivalent results from the temperature measurements. Author

N71-36786# Colorado Agricultural Experiment Station, Fort Collins.
LIST AND LOCATION OF SNOW COURSES AND SOIL MOISTURE STATIONS
1971 18 p
Avail: NTIS

The locations of snow courses and soil moisture stations in Colorado and New Mexico watersheds are listed. Maps showing the station locations are included. A.L.

N71-36787# Geological Survey, Washington, D.C.
A PROCEDURE FOR EVALUATING ENVIRONMENTAL IMPACT
Luna B. Leopold, Frank E. Clarke, Bruce B. Hanshaw, and James R. Balsley 1971 40 p refs *Its* Circ. 645
Avail: NTIS; USGS

A procedure to assist in the development of uniform environmental impact statements is presented. The heart of the system is a matrix which is general enough to be used as a reference checklist or a reminder of the full range of actions and impacts on the environmental assessment that may relate to proposed actions. The marked matrix also serves as an abstract of the text of the environmental assessment to enable the reviewers of impact reports to determine quickly significant impacts and their relative importance. The primary purpose of the procedure is to insure that the impact of alternate actions is evaluated and considered in project planning. Author

N71-36788# South Dakota School of Mines and Technology, Rapid City. Dept. of Physics.
INVESTIGATION OF THE THERMAL CONDUCTIVITY OF ICE Interim Progress Report
L. Ronald Johnson and T. Ashworth May 1970 62 p refs
(Contract N00014-68-A-0160; Proj. THEMIS)
(AD-727186; TR-27) Avail: NTIS CSCL 08/12

Measurement of the thermal conductivity of ice I (the normal phase at atmospheric pressure) over the temperature range 4 to 273 K has been attempted. First the linear absolute method was employed in which an adiabatically shielded copper block (1 kg) provided an infinitely variable heat-sink temperature with a stability of better than 1 nK/hr. Sublimation precluded adiabatic operation above 175 K; inadequate thermal coupling was apparent below this temperature. Measurements were taken on nylon both to obtain needed data and to confirm the function of the instrument; data is reported over a range of 4 to 360 K with an accuracy of 0.6% or better. The cylindrical method was adopted to overcome sublimation and bonding difficulties with ice. This allows positioning of the heating unit and measuring thermocouples within the sample; thus no shielding or hard vacuum is necessary to overcome heat loss problems. The preliminary investigation showed a random scatter of plus or minus 5%. Temperature fluctuations within the refrigerant bath were responsible for most of this scatter. By using an adjustable form factor the data follows a most probable thermal conductivity curve constructed by Morris and Smith (45) from all previously reported data. Author (GRA)

N71-36759 National Lending Library for Science and Technology, Boston Spa (England).
THE POLE-TIDE IN THE WORLD OCEAN
E. I. Seruhanjan [1971] 7 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 198, no. 3, 1969 p 571-574
(NLL-M-20630-(5628.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The main theoretical premises of the existence of the pole tide are examined, and data in support of the theory are presented. The nutation of the axis of rotation, with a period of about 14 months, creates a variation of the potential of the centrifugal force caused by the rotation of the earth. The variation in potential, or deformation force, acts on the ocean producing a tide with a period of 14 months. The amplitude of the tide is zero at the poles and the equator, and has a maximum of 8 mm at 45 deg latitude. Measurements of the fluctuations of the mean level of the major oceans of the world are tabulated and are considered to corroborate the theory. N.E.N.

N71-36760 Royal Greenwich Observatory, Herstmonceux (England).
MAGNETIC RESULTS 1962, 1963 AND 1964 (HARTLAND)
R. V. D. R. Woolley 1971 150 p /ts Bull. No. 153
Copyright. Avail: HMSO £1.50; BIS $5.40

The tabulated data include hourly means, mean monthly and annual values, and mean diurnal inequalities of the magnetic declination, and horizontal and vertical components of the magnetic intensity. N.E.N.

N71-36761 California Univ., San Diego.
A LASER EARTH STRAIN METER
Jonathan Berger (Ph.D. Thesis) 1970 147 p
Avail: Univ. Microfilms Order No. 70-16010

A laser interferometer for the study of earth strain is described. Changes in the length of an 800 m arm are measured by counting fringes in the interference pattern with a least count strain of 4 x 10 to the minus 10th power. The output is linear and has a flat response from dc to 1 MHz and a dynamic range of 1 million. The laser wavelength is controlled by reference to a passive optic resonator contained in a stable environment. The wavelength stability is a few parts in 10 to the 10th power for periods up to a laser lifetime (approximately 3000 hr). Drift and/or secular strain rates of 10 to the minus 10th power to 10 to the minus 9th power/day were observed over a period of a year. Earth tide observations are discussed with reference to the known ocean load perturbations. Observations of seismic events and microseisms are reported. Dissert. Abstr.

N71-36762 California Univ., Berkeley.
INTEGRAL EQUATION FORMULATIONS OF SCATTERING FROM TWO DIMENSIONAL INHOMOGENEITIES IN A CONDUCTIVE EARTH
John Robert Parry (Ph.D. Thesis) 1969 357 p
Avail: Univ. Microfilms Order No. 70-17637

The problem is formulated by choosing an integral representation for the electromagnetic fields in each homogeneous region present. By enforcing the boundary conditions on tangential E and H, a set of coupled integral equations results which can be solved numerically for the unknown equivalent surface current densities on the interface bounding each homogeneous region. Once these current densities are estimated, the fields can be calculated at any point from the general integral representations. The validity and accuracy of the integral equations are demonstrated by comparing numerical results with analytical results for scattering from circular cylinders in a conductive whole-space, assuming plane wave and line source incident fields. It is shown that three-dimensional source configurations can be considered by expanding the primary current distribution and the field it radiates into a Fourier integral over a continuous mode distribution. Dissert. Abstr.

N71-36763 Ohio State Univ., Columbus.
DIRECT EVALUATION OF THE EARTH'S GRAVITY ANOMALY FIELD FROM ORBITAL ANALYSIS OF ARTIFICIAL EARTH SATELLITES
Gabriel Francis Tambe Obeneson (Ph.D. Thesis) 1970 145 p
Avail: Univ. Microfilms Order No. 70-19348

Several relevant equations were developed and numerically checked, all data used being generated. These equations include appropriate variational equations relating a satellite's position at any time with its position at assumed reference epoch. An analysis was made using generated orbits for approximately 30 hours each of 5 different satellites. Since most of the input anomaly errors were recovered satisfactorily, the results adequately prove the feasibility of obtaining gravity anomalies directly from analyzing artificial earth satellite orbits. An added result is the differential correction of orbital elements and station coordinates to obtain better values. Dissert. Abstr.

N71-36764 California Univ., San Diego.
GRAVITY TIDES
William Elliston Farrell (Ph.D. Thesis) 1970 73 p
Avail: Univ. Microfilms Order No. 70-16347

A review of worldwide gravity tide data shows that ocean loading causes most of the scatter among the various observations. The perturbation of the gravity tide by the oceans can be divided into a local and a global part. the local perturbation predominates at stations within 500 km of the sea and is caused by the depression of the crust under the pressure of the local ocean tide. The disturbance that surface pressure causes in the earths gravity, tilt and strain fields has been computed for a flat earth model and a delta function pressure source. The Green's function for the gravity perturbation has been convolved with the ocean tides around England and off California and there is quantitative agreement between calculated load tides. Earth tide measurements give constraints on the offshore and deep sea ocean tides. Dissert. Abstr.

N71-36765 California Univ., Berkeley.
THE LOADING PROBLEM FOR A VISCOELASTIC EARTH
David Lowell Campbell (Ph.D. Thesis) 1969 182 p
Avail: Univ. Microfilms Order No. 70-17523

A computer modeling was done of the loading problem for a linear isotropic viscoelastic earth in an attempt to match the moats and arches seen on the ocean floor near the Hawaiian Archipelago. The general theory of viscoelasticity is discussed from the standpoint of the geophysicist, and Jeffreys and Kolsky compliances are introduced. The problem of a load on the surface of a Kolsky half-space is solved approximately. The problem of an axially symmetric Heaviside load on the surface of a layered sphere is treated under the Alterman-Jerosch-Pekeris

formulation and using a Haskell layer matrix scheme. A computer program, GLIKS, was written to find surface deformation of a loaded self-gravitating sphere consisting of Kolsky layers. Very good agreement with the Hawaiian bathymetry is found for an earth model which has an anelastic channel throughout regions B and C of the earth. Dissert. Abstr

N71-36788 Washington Univ., Seattle.
FREE OSCILLATIONS IN A BOUNDED BETA-PLANE OCEAN
Harold Oswald Mofjeld (Ph.D. Thesis) 1970 126 p
Avail: Univ. Microfilms Order No. 70-19842

Each oscillation is written as an infinite series of separable solutions to the dynamic equations which satisfy the boundary conditions at the northern boundary and the equator. A technique is developed to find the frequencies and amplitudes of the separables solutions for which the series converges to the remaining boundary conditions. The free oscillations are of two distinct types, occurring at high and low frequencies. The first type become the free oscillations in the nonrotating ocean as the rotation rate is reduced to zero. These gravity oscillations are analogous to the oscillations of the first class in the unbounded ocean. They show considerable resemblance to their counterparts in rectangular oceans with constant Coriolis parameter. The frequencies of the second type go to zero as the rotation rate is reduced to zero, and these oscillations are therefore analogous to the oscillations of the second class. These oscillations consist of cellular motion in nearly geostrophic balance which propagates westward under envelopes modulating the cells in both latitude and longitude. Dissert. Abstr.

N71-37463# Academy of Sciences (USSR), Moscow.
PENETRATION OF AURORAL PARTICLES INTO THE EARTH'S ATMOSPHERE
L. L. Lazutin *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 229-240 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

N71-36974# Environmental Science Services Administration, Washington, D.C.
TROPICAL CLOUDINESS AND RAINFALL RELATED TO PRESSURE AND TIDAL VARIATIONS
G. W. Brier and Joanne Simpson *In* Atlantic Oceanog. and Meteorol. Labs. Collected Reprints, 1969, Vol. 2 Sep. 1970 28 p refs Repr. from Quart. J. Roy. Meteorol. Soc. (England), v. 95, no. 403 p 120-147 (See N71-36973 23-20)
Avail: SOD $3.75

N71-36991# Environmental Science Services Administration, Norfolk, Va.
FIELD OCCURRENCES OF INDUCED MULTIPLE GRAVITY WAVES
Robert J. Byrne *In* Atlantic Oceanog. and Meteorol. Labs. Collected Reprints, 1969, Vol. 2 Sep. 1970 7 p refs Repr. from J. Geophys. Res., v. 74, no. 10, 1969 p 2590-2596 *Its* Contrib. 14 (See N71-36973 23-20)
Copyright. Avail: SOD $3.75

N71-36992# Atlantic Oceanographic and Meteorological Labs., Miami, Fla.
PELAGIC TIDAL MEASUREMENTS
David Cartwright (Natl. Inst. of Oceanog, Engl.), Walter Munk (Calif. Univ., La Jolla), and Bernard D. Zetler *In its* Collected Reprints, 1969, vol. 2 Sep. 1970 6 p refs Repr. from Trans. Amer. Geophys. Union, v. 50, no. 7 p 472-477 (See N71-36973 23-20)
Avail: SOD $3.75

N71-36993# Environmental Science Services Administration, Honolulu, Hawaii.
BRIGHTNESS VARIATIONS OF THE WHITE LIGHT CORONA DURING THE YEARS 1964 - 1967
Richard T. Hansen (High Altitude Obs., Kamuela, Hawaii), Charles J. Garcia (High Altitude Obs., Kamuela, Hawaii), Shirley F. Hansen (High Altitude Obs., Kamuela, Hawaii), and Harold G. Loomis *In* Atlantic Oceanog. and Meteorol. Labs. Collected Reprints, 1969, vol. 2 Sep. 1970 17 p refs Repr. from Solar Phys. (Netherlands), v. 7, 1969 p 417-433 (See N71-36973 23-20)
Copyright. Avail: SOD $3.75

N71-36995# Pacific Oceanographic Lab., Seattle, Wash.
ANOMALOUS TEMPERATURE OF BOTTOM WATER IN THE PANAMA BASIN
Norman P. Laird *In* Atlantic Oceanog. and Meteorol. Labs. Collected Reprints, 1969, vol. 2 Sep. 1970 3 p refs Repr. from J. Mar. Res., v. 27, no. 3, 1969 p 355-357 (See N71-36973 23-20)
Avail: SOD $3.75

N71-36996# Pacific Oceanographic Lab., Seattle, Wash.
BOTTOM CURRENT MEASUREMENTS IN THE TASMAN SEA
N. P. Laird and T. V. Ryan *In* Atlantic Oceanog. and Meteorol. Labs. Collected Reprints, 1969, vol. 2 Sep. 1970 6 p refs Repr. from J. Geophys. Res., v. 74, no. 23, 1969 p 5433-5438 (See N71-36973 23-20)
Copyright. Avail: SOD $3.75

N71-36997# Environmental Science Services Administration, Honolulu, Hawaii.
LONG WAVES ALONG A SINGLE-STEP TOPOGRAPHY IN A SEMI-INFINITE UNIFORMLY ROTATING OCEAN
J. C. Larsen *In* Atlantic Oceanog. and Meteorol. Labs. Collected Reprints, 1969, vol. 2 Sep. 1970 5 p refs Repr. from J. Mar. Res., v. 27, no. 1, 1968 p 1-6 (See N71-36973 23-20)
Avail: SOD $3.75

N71-36998# California Univ., La Jolla. Scripps Inst. of Oceanography.
HEAT TRANSFER IN THE TOP MILLIMETER OF THE OCEAN
E. D. McAlister and William McLeish *In* Atlantic Oceanog. and Meteorol. Labs. Collected Reprints, 1969, vol. 2 Sep. 1970 7 p refs Repr. from J. Geophys. Res., v. 74, no. 13, 1969 p 3408-3414 (See N71-36973 23-20)
Copyright. Avail: SOD $3.75

N71-36999# Environmental Science Services Administration, Washington, D.C.
THE POTENTIAL APPLICATION OF REMOTE SENSING TO SELECTED OCEAN CIRCULATION PROBLEMS
Raymond M. Nelson *In* Atlantic Oceanog. and Meteorol. Labs. Collected Reprints, 1969, vol. 2 Sep. 1970 8 p refs Repr. from Oceans from Space, p 38-45 (See N71-36973 23-20)
Avail: SOD $3.75

N71-37000# Atlantic Oceanographic and Meteorological Labs., Miami, Fla. See Air Interaction Lab.
A FOURTH BRINE HOLE IN THE RED SEA?
Feodor Ostapoff *In its* Collected Reprints, 1969, vol. 2 Sep. 1970 4 p refs Repr. from Hot Brines and Recent Heavy Metal Deposits in the Red Sea, p 18-21 (See N71-36973 23-20)
Avail: SOD $3.75

N71-37001# Pacific Oceanographic Lab., Seattle, Wash.
DEEP WATER PROPERTIES AND FLOW IN THE CENTRAL NORTH PACIFIC
R. K. Reed *In* Atlantic Oceanog. and Meteorol. Labs. Collected Reprints, 1969, vol. 2 Sep. 1970 9 p refs Repr. from J. Mar. Res., v. 27, no. 1, 1969 p 24-31 (See N71-36973 23-20)
Avail: SOD $3.75

N71-37008# Atlantic Oceanographic and Meteorological Labs., Miami, Fla. Physical Oceanography Lab.
TIDAL MODULATION OF THE FLORIDA CURRENT SURFACE FLOW
John A. Smith (Miami Univ., Fla.), Bernard D. Zetler, and Saul Breide (Miami Univ., Fla.) *In its* Collected Reprints, 1969, vol. 2 Sep. 1970 6 p refs Repr. from J. Mar. Technol. Soc., vol. 3, no. 3, May 1969 p 41-46 (See N71-36973 23-20)
(Contract Nonr-4008(02))
Avail: SOD $3.75

N71-37006# Atlantic Oceanographic and Meteorological Labs., Miami, Fla. Physical Oceanography Lab.
FLUCTUATIONS OF THE FLORIDA CURRENT INFERRED FROM SEA LEVEL RECORDS
C. Wunsch (MIT), D. V. Hansen, and B. D. Zetler *In its* Collected Reprints, 1969, vol. 2 Sep. 1970 24 p refs Repr. from Deep-Sea Res.(England), v. 16, 1969 p 447-470 (See N71-36973 23-20)
(Grant NSF GA-434)
Avail: SOD $3.75

N71-37007# Atlantic Oceanographic and Meteorological Labs., Miami, Fla.
TIDES
B. D. Zetler *In its* Collected Reprints, 1969, vol. 2 Sep. 1970 14 p refs Repr. from Handbook of Ocean and Underwater Engineering, North American Rockwell, Inc. (See N71-36973 23-20)
Avail: SOD $3.75

N71-37008# Atlantic Oceanographic and Meteorological Labs., Miami, Fla. Physical Oceanography Lab.
COMPUTER APPLICATIONS TO TIDE AND CURRENT ANALYSIS IN THE COAST AND GEODETIC SURVEY
Bernard D. Zetler *In its* Collected Reprints, 1969, vol. 2 Sep. 1970 3 p refs Repr. from Proc. of the Symp. on Tides, Monaco, 1967 (See N71-36973 23-20)
Avail: SOD $3.75

N71-37009# Atlantic Oceanographic and Meteorological Labs., Miami, Fla.
SHALLOW-WATER TIDE PREDICTIONS
Bernard D. Zetler *In its* Collected Reprints, 1969, vol. 2 Sep. 1970 4 p refs Repr. from Proc. of the Symp. on Tides, Monaco, 1967 (See N71-36973 23-20)
Avail: SOD $3.75

N71-37010# Atlantic Oceanographic and Meteorological Labs., Miami, Fla.
TIDE TALK
Bernard D. Zetler *In its* Collected Reprints, 1969, vol. 2 Sep. 1970 6 p Repr. from Go Boating, Miami, Jan. - Oct. 1969 (See N71-36973 23-20)
Avail: SOD $3.75

N71-37477# Naval Research Lab., Washington, D.C. Wave Propagation Branch.
REMOTE SENSING OF OCEAN EFFECTS WITH RADAR
N. W. Guinard *In its* Ocean Surface Sensing, Atmospheric Transmission, and Sci. Program notes Aug. 1971 p 1-11 refs Presented at the AGARD Conf. on Propagation Limitations in Remote Sensing, Colorado Springs, 22 Jun. 1971 (See N71-37476 23-30)
Avail: NTIS

N71-37478# Naval Research Lab., Washington, D.C. Laser Physics Branch.
ATMOSPHERIC TRANSMISSION NEAR 5 MICRONS
M. R. Pablo and W. J. Graham *In its* Ocean Surface Sensing, Atmospheric Transmission, and Sci. Program Notes Aug. 1971 p 12-15 refs (See N71-37476 23-30)
Avail: NTIS

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N71-36767*# California Univ., Riverside. Dept. of Geography.
MORE INFORMATION RELATING TO THE HIGH ALTITUDE USE OF COLOR INFRARED FILM
Robert W. Pease Jan. 1970 10 p refs
(NASA Order W-12782)
(NASA-CR-122849; PB-193512; USGS-195) Avail: NTIS CSCL 14E

Modifications to the previously recommended procedures for using auxiliary minus-filters are presented for EA-4 processing of infrared color film. With this processing, the need to equalize dye-forming layer sensitivities to combat the color shift due to air luminance is met with filters that attenuate the visual wavelengths less. Loss of cyan sensitivity due to aging, on the other hand, increases the attenuation need. Simple tests are suggested whereby the user can ascertain the sensitometric characteristics of the film. Author

N71-36788# National Inst. for Metallurgy, Johannesburg (South Africa).
AUTOMATIC TIMING OF THE NEUTRON GENERATOR COUNTING STATION
J. P. F. Sellschop, E. A. Uken, T. W. Steele, G. J. Wall, and N. D. Hulse 7 Aug. 1970 10 p
(NIM-967) Avail: AEC Depository Libraries

A brief account is given of the design and construction of an automatic timing system for the simultaneous radiometric measurement of an unknown sample (in analyzer live-time) and a reference standard (in clock time). Author (NSA)

N71-36788# Atomic Energy Establishment, Cairo (Egypt). Dept. of Accelerators and Plasma Physics Research.
INSTRUMENTS FOR MEASUREMENT OF THE SPECTRAL LINES PROFILE AND SHIFT
T. A. El-Khalafawy, L. A. Hafez, E. E. Hafez, and Ja. F. Volkov 1970 21 p refs
(UARAEE-96) Avail: AEC Depository Libraries

Two spectral instruments for fast-discharge investigation are described. One of these represents a device for a grazing spectrograph for recording line profiles via 8-channel fiber bundle array covered with the line under investigation. The other device may be used with any type of spectrograph or monochromator by using a Fabry-Perot interferometer. Light from a plasma passes through the Fabry-Perot etalon and spectrograph and is reflected from a profile dividing mirror to eight photomultipliers. Formulas are presented for calculating the width or shift of the spectral line. The device adjustment is described. Author (NSA)

N71-36770*# California Univ., Berkeley. Forestry Remote Sensing Lab.
REMOTE SENSING APPLICATIONS IN FORESTRY. THE DEVELOPMENT OF AN EARTH RESOURCES INFORMATION SYSTEM USING AERIAL PHOTOGRAPHS AND DIGITAL COMPUTERS PHOTOGRAPHS AND DIGITAL COMPUTERS Annual Progress Report
Philip G. Langley, Jan Van Roessel, David A. Sharpnack, and Robert M. Russel 30 Sep. 1970 33 p refs Sponsored in part by Dept. of Agr.
(NASA Order W-12996)
(NASA-CR-122922) Avail: NTIS CSCL 14B

Work continued: (1) to develop an operating earth resources information system oriented toward wildland application; (2) to provide techniques for scanning and interpreting aerial photographs automatically to provide inputs to the information system; and (3) to develop sampling designs which optimally utilize the information system and supplementary remote sensor and ground data for resource inventory and analysis. A systems analysis has been completed specifying the equipment and software packages needed to build the wildland information system and programs have been written for data input. Several image matching procedures for automatic mapping of forest resources using digitized stereopairs of aerial photographs have been tested. A program package for simulating scanned aerial photographs in various orientations has been written. Development of a linear discriminate function (LDF) to automatically classify forest types on panchromatic prints continued. A large scale test of a five-stage forest inventory procedure using Apollo 9 and aerial photographs was conducted on 10 million acres with a sampling error of only 13 percent on an estimate of 2.2 billion cubic feet of timber growing on 5 million acres. Author

N71-36771*# Intermetrics, Inc., Cambridge, Mass.
STANDARD INTERFACE DEFINITION FOR AVIONICS DATA BUS SYSTEMS Final Report
Alex L. Kosmala, Joseph A. Saponaro, and John P. Green, Jr. May 1971 167 p refs
(Contract NAS9-11477)
(NASA-CR-115187) Avail: NTIS CSCL 22B

The major factors that influence the design of a data bus for the avionics system of the proposed NASA Space Shuttle are discussed. Key issues in the design of the bus system are: the functions and role of the interface unit as a part of the bus system, error detection and recovery, redundancy, and bus control philosophy. Author

N71-36772*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A STUDY OF WIRE-DEPLOYING DEVICES DESIGNED TO TRIGGER LIGHTNING
Vernon J. Rossow, Harold G. Clements, and B. Pat Denardo Sep. 1971 44 p refs
(NASA-TM-X-62085) Avail: NTIS CSCL 14B

Methods were explored for deploying wire from rotating gun-launched bobbins and from nonrotating rocket-launched bobbins as a research tool in the study of atmospheric electricity and as a possible means for reducing lightning hazard to tall rockets during fueling and during ascent from the launch pad through storm clouds that may be in the area. The objective of the program was to develop a device that would deploy approximately 1 mile of steel wire (0.005 to 0.008 in. diameter) in one piece along a trajectory through the atmosphere at a velocity of 500 ft/sec or greater. Possible trajectories should include those from the vertical to one with an apogee of about 1000 ft. It should be possible to control the beginning of wire deployment so that it would start at the launch site or about 1/2 mile from the launch site. No consideration was given to features that would soften the impact of the remains of the round on the ground. Author

N71-36773*# Cornell Univ., Ithaca, N.Y. Center for Radiophysics and Space Research.
A DOUBLY MULTIPLEXING DISPERSIVE SPECTROMETER
Perry G. Phillips and Martin Harwit May 1971 7 p refs
(Grant NGR-33-010-139; Contract F19628-70-C-0128)
(NASA-CR-122645; CRSR-444) Avail: NTIS CSCL 14B

The results are presented of an analysis conducted on a dispersive spectrometer which incorporates 19 entrance and 19 exit slots. Multiplexing is accomplished by placing different masks at the entrance and exit apertures which alternately block or transmit various combinations of the desired spectral elements. The results of the analysis demonstrate the instrument's dual capability to perform either one-dimensional imaging or alternately to give a spectrum with high signal-to-noise ratio over the entire source. The findings also indicate that, in astronomical applications, the large entrance aperture may be used to observe extended diffuse regions; for compact regions, a smaller entrance aperture with fewer slots suffices. Author

N71-36774*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A FIBER OPTICS SLIT SYSTEM USED FOR TIME RESOLVED DIAGNOSTICS IN A TRANSIENT PLASMA
George H. Stickford, Jr. 15 Sep. 1971 31 p refs
(Contract NAS7-100)
(NASA-CR-122932; JPL-TM-33-492) Avail: NTIS CSCL 14B

Through the use of fiber optics, a series of very narrow slits was constructed and placed at the exit plane of a spectrograph. Plasma radiation dispersed by the spectrograph is incident on the slits and is transmitted to separate phototubes via the quartz fibers. With this technique, time-resolved measurements of the spectral shape of the hydrogen H beta line were made and used to determine the electron density of a transient plasma. With some knowledge of the pressure or density, the measurements also give the plasma temperature. Data obtained indicated that the thermodynamic conditions behind the reflected shock in a mixture of 20% H2-80% He, at incident shock speeds of 12 to 14 km/s and pressures of 66.6 to 133.3 N/sq m(0.5 to 1.0 mm Hg), correspond to theoretically predicted conditions. Immediately behind the incident shock at speeds of 17 to 24 km/s, the plasma reached equilibrium, then demonstrated a drop in intensity which was attributed to radiative cooling. At 27 km/s, the data indicated that the plasma did not reach equilibrium, presumably because the plasma cooled within the response time of the phototube intensity measurement. Author

N71-36775# Institute for Nuclear Physics Research, Amsterdam (Netherlands). Nuclear Reaction Group.
QUANTITATIVE DETAILS OF THE MULTIDETECTOR SYSTEM BOL
Mar. 1971 9 p
(KE-1) Avail: NTIS

Quantitative details of the Bol multidetector system for charged particle coincidence measurements are summarized. The system contains 64 solid state detector telescopes and combines a solid angle of 13% of 4pi and an angular resolution of 1 deg. Author

N71-36776# Advisory Group for Aerospace Research and Development, Paris (France).
RELIABILITY OF AVIONICS SYSTEMS
Jul. 1971 191 p refs Mostly in ENGLISH; partly in FRENCH Conf. held in Rome, 16-17 Sep. 1971 and London, 20-21 Sep. 1971; Sponsored by Avionics Panel and Exchange Programme of AGARD *Its* Lecture Series No. 47
(AGARD-LS-47-71) Avail: NTIS

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12. THE BENEFITS OF A TOTALLY INTEGRATED RELIABILITY TEST PROGRAM J. J. Bussolini (Grumman Aerospace Corp.) 21 p refs (See N71-36788 23-15)

13. OPERATIONAL CONSIDERATIONS AND SYSTEMS RELIABILITY B. E. Baker (Royal Air Force, High Wycombe, England) 7 p (See N71-36789 23-15)

N71-36777# McDonnell Aircraft Corp., St. Louis, Mo. Engineering Reliability.

TECHNIQUES OF SYSTEM RELIABILITY ESTIMATION, INCLUDING FAILURE EFFECT ANALYSIS (FAILURE CONSEQUENCE) c15

W. T. Sumerlin *In* AGARD Reliability of Avionics Systems Jul. 1971 29 p refs (See N71-36776 23-14)

Avail: NTIS

The reliability estimation of an avionic system, which includes gross estimates, rapid estimates, and detailed estimates is discussed. Probability of attainment is then studied by selective reliability allocation among subsystems, followed by feasibility estimates based on experience, complexity, failure rate summations and/or other effective techniques. Constraints including allowable degradation, alternative mode operation, environment, operator effectiveness, and excellence of maintenance will permit improved estimates. Failure mode and effect analyses serves to guide conceptual design decisions so as to eliminate single point failures and identify areas for judicious application of redundancy, requirements for high reliability parts, special environmental control, and beneficial choice of operating profile. Author

N71-36778# Radio Corp. of America, Moorestown, N.J.

CORRELATION BETWEEN ESTIMATION TESTS AND SYSTEM OPERATING DATA c15

M. M. Tall *In* AGARD Reliability of Avionics Systems Jul. 1971 9 p refs (See N71-36776 23-14)

Avail: NTIS

The relationships between estimation tests and operational reliability are studied by regression analysis. The analysis includes equipment complexity and average mission length. Eleven equipment pieces were tested and results show that in several cases the reliability surpassed goals established for the tests. Results also indicate the tests may be used to refine the designs and remove defects introduced by parts, materials, and manufacture. Only avionic systems are used for the tests. E.H.W.

N71-36779# McDonnell Aircraft Corp., St. Louis, Mo. Engineering Reliability.

EFFECTIVENESS OF RELIABILITY PROGRAM ELEMENTS c15

W. T. Sumerlin *In* AGARD Reliability of Avionics Systems Jul. 1971 9 p (See N71-36776 23-14)

Avail: NTIS

An opinion is given of the probable relative importance of reliability program elements including reliability requirement evaluation and allocation, proof of attainment, parts control, design surveillance, failure analysis and design correction, and reliability progress measurement. Author

N71-36780# Radio Corp. of America, Moorestown, N.J.

COST EFFECTIVENESS OF BUILT-IN TEST PROVISIONS c15

M. M. Tall *In* AGARD Reliability of Avionics Systems Jul. 1971 8 p refs (See N71-36776 23-14)

Avail: NTIS

The feasibility of using built in test provisions (BIT) as a means of improving operational effectiveness of aircraft is discussed. The primary purpose of BIT is to indicate to the user if the prime equipment is operating satisfactorily. It provides information upon which a decision to abort, modify, or continue a mission may be based. Bit may also be applied to passive devices. In highly complex equipment BIT may indicate degrade performance of portions of the equipment as well as catastrophic failure, and indicate the use of any alternate mode of operations. The cost effectiveness of BIT is also discussed. E.H.W.

N71-36781# Grumman Aerospace Corp., Bethpage, N.Y. Engineering Operations and Administration.

HIGH RELIABILITY DESIGN TECHNIQUES APPLIED TO THE LUNAR MODULE c15

J. J. Bussolini *In* AGARD Reliability of Avionics Systems Jul. 1971 34 p refs (See N71-36776 23-14)

Avail: NTIS

A description is given of the significant design techniques applied to the lunar module to attain system reliability. The use of system work-arounds, functional redundancy, hi-rel parts screening, successive stage building block testing, vehicle testing, overstress testing, failure mode and effect analysis and many other techniques are described, illustrating their relative importance toward the success of the program. Author

N71-36782# Siemens-Schuckertwerke A. G., Munich (West Germany).

TESTING THE RELIABILITY OF AVIONIC EQUIPMENT FOR SPACECRAFT APPLICATIONS c15

Guenter Vollhardt *In* AGARD Reliability of Avionics Systems Jul. 1971 10 p (See N71-36776 23-14)

Avail: NTIS

To assess the stress limits and failure modes of spacecraft equipment, models were constructed and tested under various stresses and environmental conditions. The tests show failure to be caused by errors in mechanical or electrical design and drift of electrical and mechanical parts. Circuit analyses as well as mechanical and climatic tests were conducted. E.H.W.

N71-36783# Grumman Aerospace Corp., Bethpage, N.Y. Engineering Operations and Administration.

METHODS OF SPECIFYING AND CONTROLLING DESIGN RELIABILITY c15

J. J. Bussolini *In* AGARD Reliability of Avionics Systems Jul. 1971 19 p refs (See N71-36776 23-14)

Avail: NTIS

Some examples of techniques used to accomplish early

determination of system and equipment reliability requirements, the methods use to specify these requirements and the contractual techniques used to test and demonstrate compliance to specification requirements are examined. Incentive--penalty contracting for reliability is discussed including recommendations for relating these incentives and penalties to conventional and modified demonstration test techniques. Author

N71-36784# Radio Corp. of America, Moorestown, N.J.
RELATIONSHIPS BETWEEN PROGRAM TEST AND USER SUPPORT COSTS c15
M. M. Tell *In* AGARD Reliability of Avionics Systems Jul. 1971 9 p refs (See N71-36776 23-14)
Avail: NTIS

The significant factors that should be included in a cost ownership analysis of avionic equipments are discussed. The value of reliability improvement efforts, including AGREE type test programs, are assessed. Author

N71-36785# McDonnell Aircraft Corp., St. Louis, Mo. Engineering Reliability.
SYSTEM OPERATIONAL CONSIDERATIONS AND THEIR RELATIONSHIP TO THE TEST PROCESS c15
W. T. Sumerlin *In* AGARD Reliability of Avionics Systems Jul. 1971 8 p refs (See N71-36776 23-14)
Avail: NTIS

Indicators, for raising the reliability of a system hardware unit through burn-in, tests, failure analysis, and corrective design changes, are discussed. Mean time between failure (MTBF) is used as an index of reliability to describe the operational requirements and to relate these requirements to tests and verification observations. The limitations and constraints of MTBF are also discussed. E.H.W.

N71-36786*# Centre National d'Etudes des Telecommunications, Lannion (France).
TECHNIQUES OF ANALYZING ACCELERATION [LA TECHNIQUE DES ESSAIS ACCELERES] c23
P. Blanquart *In* AGARD Reliability of Avionics Systems Jul. 1971 18 p In FRENCH (See N71-36776 23-14)
Avail: NTIS

The reliability of electronic components after acceleration tests is discussed. The effects of vibration, humidity, and temperature on degradation are considered. Mathematical models and regression analysis are also discussed. E.H.W.

N71-36787# Grumman Aerospace Corp., Bethpage, N.Y. Engineering Operations and Administration.
THE BENEFITS OF A TOTALLY INTEGRATED RELIABILITY TEST PROGRAM c15
J. J. Bussolini *In* AGARD Reliability of Avionics Systems Jul. 1971 21 p refs (See N71-36776 23-14)
Avail: NTIS

The benefits derived from a totally integrated test program in terms of cost, schedule, and resultant system reliability are discussed. Author

N71-36788# Royal Air Force, High Wycombe (England). Strike Command.
OPERATIONAL CONSIDERATIONS AND SYSTEMS RELIABILITY c15
B. E. Baker *In* AGARD Reliability of Avionics Systems Jul. 1971 7 p (See N71-36776 23-14)
Avail: NTIS

The problem of deciding what reliability to specify and how to ensure that this reliability is achieved is discussed. An example is given of trade-offs between reliability and maintainability and performance parameters. The need for a formal reliability program is stressed and parts of this are discussed in detail. The value of reliability testing at the end of development is illustrated by a costed example. Author

N71-36789# Sandia Labs., Albuquerque, N.Mex.
HIGH INTENSITY DIRECT READING HEAT FLUX GAUGE
H. C. Hardee and A. B. Donaldson Apr. 1971 9 p refs Sponsored by AEC
(SC-DR-710194) Avail: NTIS

A high intensity direct reading heat flux gauge is described. The device, can be used under a wide variety of field test conditions. The gauge is a quasi-steady state type and, offers advantages over both the steady-state and the transient types. Because the signal output is directly proportional to the incident heat flux, data reduction errors are minimized. The device has the capability of a secondary, transient type measurement which provides a check on the primary measurement. A lab test was conducted in which the measurements obtained from the direct reading gauge were compared with measurements obtained from a calibrated steady-state gauge. Author (NSA)

N71-36790# Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex.
PHOTOGRAPHIC AND OPTICAL SYSTEMS ANALYSIS
Stephen Kelly Mar. 1971 10 p
(Contract DA-11-173-AMC-487(A))
(MHSMP-71-32) Avail: NTIS

A comparison of two high speed films for use in streak camera recording systems and a study of suitable materials for use as front windows in argon candles are presented. Author

N71-36791# Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex.
A 12.5 KJ CAPACITOR BANK Final Report
R. D. Worley Mar. 1971 6 p
(Contract DA-11-173-AMC-487(A))
(MHSMP-71-33) Avail: NTIS

The 12.5KJ capacitor bank located in the firing site (FS-10A) is described. It has the capability of delivering 100 Kamps at 40 kv into a short circuit. The ringing frequency is 56 KHz, and the inductance and resistance of the unit is 800 nh and 20 micro ohms, respectively. Recommended design changes required to improve the system are also listed. Author

N71-36792# Rome Univ. (Italy). Inst. of Physics.
THE TRACK ETCHING IN PLASTICS AS FUNCTION OF THE EXPOSURE TEMPERATURE
G. Baroni 9 Dec. 1970 11 p refs *Its* Nota Interna No. 282
Avail: NTIS

Particle detection properties of cellulose nitrate and Marcofol E were investigated after heating for outgassing in the vacuum chambers of particle accelerators. Etching (photographic development) and heating temperature were used as variables. Half the samples were irradiated before, the other half after heating. The experiments showed a regular behavior with developing time and temperature. ESRO

N71-36793# Compagnie Francaise Thomson Houston-Hotchkiss Brandt, Paris.
DEVELOPMENT OF A DEVICE SHOWING THE CHARACTERISTICS OF A VISUALIZATION PROCEDURE ON PHOTOCHROMIC FILM [REALISATION D'UN DISPOSITIF PERMETTANT DE METTRE EN EVIDENCE LES CARACTERISTIQUES D'UN PROCEDE DE VISUALISATION SUR FILM PHOTOCHROMIQUE]
[1970] 33 p In FRENCH Sponsored by DGRST
Avail: NTIS

A visualization device was developed which records on a photochromic film producing a 12 x 18 millimeter image which was previously recorded on a magnetic tape. Due to the low sensibility of the film, an argon laser is used. The scanning is performed by a galvanometer, and a rotating mirror with which a 600 line, 400 spot per line image can be scanned in ten seconds. ESRO

N71-36794# Royal Greenwich Observatory, Herstmonceux (England).
THE ISAAC NEWTON TELESCOPE CASSEGRAIN SPECTROGRAPH. DESCRIPTION AND RESULTS OF RADIAL-VELOCITY OBSERVATIONS OF STARS NEAR DELTA(2) LYRAE
G. A. Harding and M. P. Candy 1971 11 p refs /ts Bull. No. 164
Avail: NTIS; Royal Greenwich Obs., Herstmonceux Castle, Hailsham, Sussex, Engl.: £0.20

The general arrangement of the Cassegrain spectrograph for use with the Isaac Newton Telescope is described and its applications are discussed. Radial velocity observations of early-type stars near Lyrae cluster were made and data from about 25 spectra of 11 of the stars are presented. A.L.

N71-36795*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOME LIMITATIONS ON THE USE OF DAMPING IN SHORT PRESSURE PROBES
Ted W. Nyland and Robert C. Anderson Washington Oct. 1971 26 p refs
(NASA-TN-D-6526; E-6377) Avail: NTIS CSCL 14B

Changes in the useful frequency response of probes resulting from variations in the viscous damping within the probe tube are examined. The Bergh and Tijdeman recursion formula, which was modified to allow the addition of arbitrary amounts of viscous loss in any tube section, is used. Results show that the useful response range can be increased with damping, but it is dependent on the operating temperature and pressure levels. At 300 K, only a 15 per cent variation in average pressure is allowable if the useful response is to be a factor of three higher than that of an undamped probe. The variation increases to 20 or 30 per cent at temperatures above 600 K. A computer program based on the modified formula is given in an appendix. Author

N71-36796# Stanford Linear Accelerator Center, Calif.
MAGNETIC SPECTROMETERS
W. K. H. Panofsky Sep. 1970 49 p refs Presented at the High Energy Phys. Instrumentation Conf., Dubna, 8-12 Sep. 1970 Sponsored by AEC
(SLAC-PUB-798) Avail: NTIS

Magnetic spectrometers designed for use at high particle energies are reviewed. The discussion is restricted to those devices designed for analysis of particles emanating from a target where emphasis is placed on measuring the production angles and momenta, and where resolution and identification is achieved primarily through production kinematics and not through time coincidence or decay mechanism. Wide and small aperture spectrometers are considered. J.G.M.

N71-36797# National Aviation Facilities Experimental Center, Atlantic City, N.J.
AN ACCURACY EVALUATION OF A TAXI SPEED AND DISTANCE MEASURING DEVICE Final Report, Jan. - Jun. 1970
Robert H. Pursel Sep. 1971 25 p
(FAA-NA-71-19; FAA-RD-71-53) Avail: NTIS

The device used a modifed skid detector assembly as a sensor. The skid detector assembly was mechanically coupled to the aircraft wheel and thus sensed wheel rotation. Accuracy measurements were made on the device and it was found to meet design accuracy specification for distance measurement. In two cases, speed errors occurred which were in excess of the design specification, but it was felt that this would not degrade the operational usability of the speed measuring equipment. The distance measuring portion of the equipment will require modifications to overcome some limitations before the utility of the distance measuring portion of the device can be investigated. Author

N71-36798# Aeronautical Quality Assurance Directorate, Uxbridge (England).
AN ABSOLUTE METHOD OF PIEZO-ELECTRIC ACCELEROMETER CALIBRATION
H. Gregory Feb. 1970 41 p refs
(AQD/Y/7) Avail: NTIS

A fundamental method of calibrating accelerometers has been developed which measures dynamic displacement, the essential and difficult parameter, by a pair of differentially coupled solar, silicon photo-cells which are calibrated statically against a length standard. The method employs a null technique, is fast in operation requiring only the adjustment of a precision, variable capacitor and is largely independent of vibrator driving source waveform. The facility provides calibration in the frequency range 200 Hz to 5000 Hz at acceleration levels up to 50g with an uncertainty not greater than plus or minus 3 percent. Author

N71-36799# Aeronautical Quality Assurance Directorate, Uxbridge (England).
AN IMAGE SHEARING TECHNIQUE USED IN THE CALIBRATION OF ACCELERATION TRANSDUCERS
G. A. Yeates and H. Gregory Jan. 1970 9 p
(AQD/Y7/2) Avail: NTIS

The use of an image shearing eyepiece for the fundamental determination of the magnitude of displacement of a vibrating system with special reference to the calibration of acceleration transducers vibrated with sinusoidal displacements, is described. The inaccuracy of measurement is shown to be of the order of + or - 2.5 percent. Author

N71-36800# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
CALIBRATION OF A CONDENSER MICROPHONE MICROMETEOROID SENSOR
Robert L. Evans Sep. 1970 62 p refs Sponsored by Natl. Res. Council of Can.
(UTIAS-TN-157) Avail: NTIS

A detailed calibration study of a 2-in.dia. open area condenser microphone micrometeoroid impact sensor is presented. The calibration results show that the sensor responds linearly to incident particle momentum in the design range of 0.00001 to ten to the minus seven dyne-secs. Both drop tests and hypervelocity impact tests have been made. Velocities up to 7 km/sec have been achieved using an electrostatic dust particle accelerator. A mathematical analysis of the diaphragm vibration mechanism has been successful in predicting the type of waveform and the operating modes of the sensor. Author

N71-36801# Joint Publications Research Service, Washington, D.C.
USE OF INFRARED DEVICES IN OBSERVATIONS OF ICE CONDITIONS
F. I. Melkov et al 30 Sep. 1971 15 p refs Transl. into ENGLISH from the publ. "Primeniye Radiofizicheskikh Metodov v Okeanograficheskikh i Ledovykh Issledovaniyakh" Leningrad, 1965 p 95-106
(JPRS-54162) Avail: NTIS

Observations of ice conditions from an airplane by photography, by the use of television, or by using passive or active radio-locating devices, infrared techniques, and other devices operating on the principle of receiving radiated or reflected electromagnetic waves are discussed. All of these devices have their advantages and disadvantages. Photography and television assure a high resolution capability but their use requires sufficient illumination and the absence of cloud and fog. Radio location equipment in the centimeter range can be used for ice prospecting even in the presence of clouds and fog, but with extremely poor resolution. A complete solution of the problems of ice prospecting can be accomplished only with the use of a combination of devices operating in various parts of the electromagnetic wave spectrum. The use of a combination of various apparatus smooths out the disadvantages of any one system and reinforces their positive values. Author

N71-36802# National Bureau of Standards, Washington, D.C. Optical Physics Div.
TESTING OF COVER GLASSES FOR HEMACYTOMETER CHAMBERS
John S. Beers Sep. 1971 7 p
(NBS-TN-579) Avail: SOD $0.20

Volume errors, causing erroneous blood counts, which are introduced into hemacytometer chambers from nonuniform cover glass surfaces are discussed. An interferometric method of testing cover glasses for conformity to a planarity specification is described. Author

N71-36803# Army Foreign Science and Technology Center, Charlottesville, Va.
TEMPERATURES OF POLYMERS [TEMPERATURA POLIMEROV]
V. Sologyan et al 13 Jul. 1971 8 p Transl. into ENGLISH from Nauchn-Tekhn. Obshchestva (USSR), no. 10, 1970 p 20-21
(AD-727340; FSTC-HT-23-989-71) Avail: NTIS CSCL 14/2

Three types of instruments for measuring the temperature of polymers are discussed. To measure radiation of heat, 1 A thermocouple or thermistor and 2 A potoelectrical receiver are used. The temperature is also measured by dielectric methods. Author

N71-36804 National Lending Library for Science and Technology, Boston Spa (England).
BELL AND HOWELL TYPE 4-367-0292 RELATIVE PRESSURE TRANSDUCER [FICHE TECHNIQUE DU CAPTEUR DE PRESSION RELATIVE BELL AND HOWELL TYPE 4-367-0292]
Gaz De France 1971 11 p Transl. into ENGLISH from French report In FRENCH and ENGLISH
(NLL-M-20618-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A small compact relative pressure transducer is described. The temperature effects, metrological characteristics, and the drift rate of the instrument are discussed. The transducer can be calibrated or readjusted remotely, and can be supplied in an absolute pressure version. Gas flow measurements under high pressure are also discussed. E.H.W.

N71-36805 National Lending Library for Science and Technology, Boston Spa (England).
USE OF RADIATION BALANCE DATA TO DETERMINE EVAPORATION FROM THE SURFACE OF THE LAND
T. A. Ogneva 2 Mar. 1971 8 p ref Transl. into ENGLISH from Leningrad. Glav. Geof. Obs., Actinom. Atmos. Optics, Proc. .7th Inter-Dept. Conf., Leningrad, May 1968, 1969 p 196-200
(NLL-M-20366-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The advantages and use of the heat balance method for determining evaporation is discussed. It is reported that in the Soviet Union the method has found its widest application in determining the amount of evaporation from adequately damp soil which is bare or has a small covering of vegetation. Two components of the heat balance were computed: the turbulent flux of heat h and the flux P of heat through the surface of the soil. This was done by using a set of individual measurements of the differences of air temperature, water vapor pressure, and wind speed in the layer from 0.5 to 2.0 m together with the temperature and humidity of the soil at depths of 0.5, 0, 5, 10, 15, and 20 cm. The consumption V of heat in evaporation and from that the value of evaporation itself can then be computed as the remaining term in the equation of heat balance; i.e., V = B - P - h, where B is the influx of radiation. Author

N71-36806 National Lending Library for Science and Technology, Boston Spa (England).
PHOTOGRAPHING OF SMOKE PLUMES FROM INDUSTRIAL SOURCES
V. S. Eliseev [1971] 12 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 238, 1969 p 86-95
(NLL-M-20654-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The application of photographic techniques to the filming of smoke plumes from industrial sources as method for determining the characteristics of atmospheric turbulence is discussed. A numerical analysis of the variables associated with the operation is presented. A method for accurate assessment of the photographic record is described. Author

N71-36807 National Lending Library for Science and Technology, Boston Spa (England).
CONTRIBUTION TO THE MEASUREMENT OF DEPTH RESOLUTION OF ANGLE PROBES
R. Hornung [1970] 8 p Transl. into ENGLISH from Schweiz. Arch. Angew. Wiss. Tech. (Solothurn, Switz.), v. 36, 1970 p 73-75
(NLL-CE-Trans-5573-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The use of the bevelled test blocks and their use in connection with the testing of angle probes is outlined. Oscilloscope traces are reproduced to show the results obtained by using the new test blocks. Other traces show the effect of using probes with different types of transducers. Author

N71-36808 Rochester Univ., N.Y.
THEORY AND DESIGN OF UNUSUAL CONCAVE GRATINGS
John Dwane Baumgardner (Ph.D. Thesis) 1970 266 p
Avail: Univ. Microfilms Order No. 70-17864

Technological advances in rocket techniques have made possible the study of far ultraviolet spectra of stellar sources with high resolution spectrographs. It is found that spectrographs of this type require special techniques for aberration control. These techniques included deforming the grating surface, using an off-plane mount, and altering the rulings. Using an optical path difference approach as a basis for an aberration theory of the concave reflection grating, expressions are derived for predicting the necessary grating modifications to control astigmatism, coma, and off-plane image rotation. A computer design program was used to obtain significant improvements in the performance of three Wade-worth type, far ultraviolet high resolution rocket-borne spectrographs. The present art of grating manufacture allows the production of gratings with unusual surface figures. Consequently, some of the theoretical results are immediately applicable. With regard to gratings with unusual ruling patterns, the theory advances the state of the art of grating design beyond present capabilities of grating manufacture. Dissert. Abstr.

N71-36990# Society of Motion Picture and Television Engineers, Inc., New York.
CLOUD PHOTOGRAMMETRY FROM AIRBORNE TIME LAPSE PHOTOGRAPHY
Luis M. H. Cantilo (Miami Univ.) and William L. Woodley (Miami Univ.) *In* Atlantic Oceanog. and Meteorol. Labs. Collected Reprints, 1969, Vol. 2 Sep. 1970 11 p refs Presented at 105th Tech. Conf., 20-25 Apr. 1969 Sponsored by ESSA Its Preprint No. 105-52 (See N71-36973 23-20)
Avail: SOD $3.75

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N71-36809*# Northwestern Univ., Evanston, Ill. Dept. of Mechanical Engineering.
DYNAMIC RESPONSE AND STABILITY OF A GAS-LUBRICATED RAYLEIGH-STEP PAD
Chi Cheng and H. S. Cheng Jul. 1971 141 p refs
(Grant NGR-14-007-093)
(NASA-CR-122949) Avail: NTIS CSCL 13I

The quasi-static, pressure characteristics of a gas-lubricated thrust bearing with shrouded, Rayleigh-step pads were determined for a time-varying film thickness. The axial response of the thrust bearing to an axial forcing function or an axial rotor disturbance was investigated by treating the gas-film as a spring having nonlinear restoring and damping forces. These forces are related to the film thickness by a power relation. The nonlinear equation of motion in axial mode was solved by the Ritz-Galerkin method as well as the direct, numerical integration. Results of the nonlinear response by both methods are compared with the response based on the linearized equation. Further, the gas-film instability of an infinitely-wide Rayleigh step thrust pad was determined by solving the transcient Reynolds equation coupled with the equation of the motion of the pad. Results show that the Rayleigh step geometry is very stable for bearing number, Lambda, up to 50. The stability threshold is shown to exist only for ultrahigh values of Lambda < or = to 100 where the stability can be achieved by making the mass heavier than the critical mass. Author

N71-36810*# Callery Chemical Co., Pa.
A 200-POUND DIBORANE SHIPPING CONTAINER: DESIGN AND PERFORMANCE
Jun. 1971 31 p
(Contract NASw-1827)
(NASA-CR-122952; CCC-71-12) Avail: NTIS CSCL 13D

A brief description of a 200 lb diborane shipping container design is presented including instrumentation for indicating temperature, pressure, and liquid level. Storage time, volumetric loading, and pressure-temperature limitations are discussed and performance data are given. Data on the container preparation, charging, and storage tests are included. J.M.

N71-36811*# Atomics International, Canoga Park, Calif.
LITHIUM HYDRIDE SHIELD SEGMENT FABRICATION Final Report
F. H. Welch 3 Sep. 1971 59 p refs
(Contract NAS3-13466)
(NASA-CR-120782; Ai-71-40) Avail: NTIS CSCL 13H

Four shield segments were designed, built, and filled with lithium hydride by a casting process. The segments were sectors of a right circular cylindrical annulus. The cylindrical annulus, 0.747 m in diameter and 0.925 m high, contained 160 kg of high purity natural lithium hydride in the 0.133 m thick walls. Three of the four segments contained penetrations through the lithium hydride, which will be used in tests of radiation streaming through ducts. Author

N71-36812# Atomic Energy of Canada, Ltd., Pinawa (Manitoba). Whiteshell Nuclear Research Establishment.
FABRICATION AND BURST TESTING OF REACTION-BONDED SILICON CARBIDE TUBES
E. Phillips and W. Hutchings Feb. 1971 51 p refs
(AECL-3462) Avail: AEC Depository Libraries; AECL $1.50

The fabrication of silicon carbide discs, rods, tubes, and slabs by reaction-bonding is described. The effects of silicon carbide particle size, graphite type and content, and fabrication pressure on the ease and uniformity of silicon impregnation during reaction-bonding are discussed. Microstructures and hoop tensile strengths obtained from hydrostatic burst tests on reaction-bonded tubes are presented and compared with results obtained with commercially available reaction-bonded tubes. The best WNRE tubes had an average grain size of 5 microns, contained less than 10 wt % free silicon and broke at an average hoop tensile stress of 21,800 lbf/sq in. Author

N71-36813*# International Business Machines Corp., Gaithersburg, Md. Federal Systems Div.
AUTOMATED ANESTHESIA MACHINE REPORT ON BREADBOARD TESTING
23 Aug. 1971 14 p
(Contract NASw-2201)
(NASA-CR-122648) Avail: NTIS CSCL 13I

Anticipated problems encountered with a high pressure gas conditioning system, whose flow to/from the patient was regulated by a controllable demand valve, resulted in a change of design to a volume displacement configuration. This configuration was further refined in an effort to reduce size and noise levels. The changes consisted of using the conventional single bellows inside a pressure chamber and operating magnetically actuated reed switches for tidal volume control. Breadboard construction and testing are described and recommended final specifications are given. D.L.G.

N71-36814*# Martin Marietta Corp., Denver, Colo.
COMPOSITE OVERWRAPPED METALLIC TANKS Interim Report, 1 Jul. 1968 - 28 Feb. 1970
A. Feldman and A. Holston, Jr. Oct. 1971 180 p refs
(Contract NAS3-12023)
(NASA-CR-72765; MCR-70-350) Avail: NTIS CSCL 13H

A two-part program involving tests of 5Al - 21/2Sn titanium (ELI) and a design computer program revision and use was undertaken to investigate the feasibility of a fiberglass-epoxy overwrapped titanium pressure vessel. The effects of cryogenic temperature and various manufacturing processes on the titanium were studied experimentally. An existing design computer program was revised to account for a variable thickness liner in the domes and thereby increase efficiency. A vessel was designed with the properties determined in the experimental phase. It is concluded that the operational concept of permitting a state of compressive stress in the liner with zero internal pressure will result in a lighter weight vessel. Author

N71-36815*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio. Environmental Lab.
DESIGN FEATURES AND RESULTS FROM FATIGUE RELIABILITY RESEARCH MACHINES
Vincent R. Lalli, Dimitri Kececioglu (Arizona Univ., Tucson), and Jeffrey B. McConnell (Hughes Aircraft Co., Tucson, Ariz.) 1971 22 p refs Presented at the Soc. for Exptl. Stress Analysis, Milwaukee, 19-22 Oct. 1971
(NASA-TM-X-67949; E-6580) Avail: NTIS CSCL 13I

The design, fabrication, development, operation, calibration and results from reversed bending combined with steady torque fatigue research machines are presented. Fifteen centimeter long, notched, steel specimens were subjected to various combinations of these stresses and cycled to failure. Failure occurred when the crack in the notch passed through the specimen automatically shutting down the test machines. The cycle-to-failure data for various combinations of stress ratios and bending stresses have been statistically analyzed to develop probabilistic S-N diagrams to be used in modified Goodman diagrams for designing specified reliability into rotating components. Author

N71-36816*# Martin Marietta Corp., Denver, Colo.
RESTRAINT SYSTEM DEVELOPMENT. VOLUME 1 Final Report

B. J. Buell and Joseph C. Spencer Jul. 1970 70 p 2 Vol.
(Contract NAS8-24840)
(NASA-CR-119951; MCR-70-222-Vol-1) Avail: NTIS CSCL 13I

A full-scale prototype of a restraint system was developed and delivered to NASA-MSFC. The restraint system is a device which provides the restraining forces necessary to allow the performance of maintenance and repair tasks by a man in a zero-gravity environment. The system is designed to be worn by the man, provide attachment of the man to structure at a work site, allow mobility once attached, and provide rigid restraint at any position within the mobility envelope when desired. Author

N71-36817*# Martin Marietta Corp., Denver, Colo.
RESTRAINT SYSTEM DEVELOPMENT. VOLUME 2: DESIGN DRAWINGS Final Report
B. J. Buell and Joseph C. Spencer Jul. 1970 47 p
(Contract NAS8-24840)
(NASA-CR-119952; MCR-70-222-Vol-2) Avail: NTIS CSCL 13I

Design drawings of the prototype restraint system for repair and maintenance by astronauts under weightless conditions are presented. A.L

N71-36818*# Pratt and Whitney Aircraft, West Palm Beach, Fla. Research and Development Center.
ADVANCED BEARING STUDY. PART 2: BEARING TESTS Final Report
C. R. Comolli, R. Newton, and R. E. Dotson 8 Sep. 1971 125 p
(Contract NAS3-7943)
(NASA-CR-72280; PWA-FR-3960-Pt-2) Avail: NTIS CSCL 13I

Twenty 110 mm ball bearing tests in liquid hydrogen were conducted with bearings constructed of material combinations selected from the materials evaluation portion of this program. In thirteen of these tests the bearings consisted of AISI 440 C races and balls with Chemlov 719 cages supplying the lubricant. A successful 15 min test at a rotational speed of 12,000 rpm (1256 rad/s) and an axial load of 9,000 lb (40,034 N) was completed with this configuration. Five tests were made with bearings consisting of AISI 440 C races, Stellite Star J balls, and Selox M for the cage material. A successful 33 min test at a rotational speed of 13,000 rpm (1361 rad/s) and an axial load of 7,200 lb (32,027 N) was completed with this combination. The remaining two tests were made with bearings consisting of AISI 440 C races and balls and a Selox-M cage. A total of 35.1 min at 13,000 rpm (1361 rad/s) and a 7,200-lb (32,027 N) load was accumulated with this material combination. Star J ball failures that occurred in two tests were attributed to poor ball material grain structures. Failures experienced with the AISI 400 C races and balls were associated with failure of the cages due to wear and/or fractures. Author

N71-36819*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN APPLICATION OF FAILURE FLOW ANALYSIS TO A GSFC SPACECRAFT PROJECT
Robert E. Heuser Aug. 1971 57 p refs
(NASA-TM-X-65706; X-326-71-348) Avail: NTIS CSCL 14D

The use of failure flow analysis to evaluate the test program of the Interplanetary Monitoring Platform I (IMP-I) spacecraft is discussed. The flow of defects from point of origin to point of detection is mapped. The effectiveness of the various screen systems is calculated, and the reasons for escape from the screens is presented. The distribution of causes of defects is examined, and the criticality of the defects is determined. The flight results are compared to the test performance. The flight results seem to show the ability of a protoflight test program to detect fabrication caused defects. Author

N71-36820*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTS ON THE STABILITY OF WATER-LUBRICATED RAYLEIGH STEP HYDRODYNAMIC JOURNAL BEARINGS AT ZERO LOAD
Fredrick T. Schuller Washington Sep. 1971 30 p refs
(NASA-TN-D-6514; E-6277) Avail: NTIS CSCL 13I

Tests were conducted with four different journal bearing configurations. The bearings, with nominal 1.5-in. diameter and length, were tested at 80 F at speeds to 6300 rpm. In this report a pad is defined as a combination of feed groove and step, and ridge regions. A segment is defined as an independently acting 360 deg region; it may incorporate one or more pads. The four stepped-bearing configurations tested, in order of diminishing stability were: one-segment, three-pad shrouded; one-segment, one-pad shrouded; one-segment, three-pad unshrouded; and three-segment, one-pad shrouded. An increase in stability can be gained with a shrouded over an unshrouded step bearing. Stability becomes more sensitive to the ratio of step to ridge film thickness as clearance is increased. Five fixed geometry bearings were rated in order of diminishing stability as follows: (1) three-lobe bearing with minimum film thickness at trailing end of each lobe, (2) herringbone-groove bearing, (3) one-segment, three-pad shrouded Rayleigh step bearing, (4) three-lobe bearing, centrally lobed, and (5) three-segment, one-pad shrouded Rayleigh step bearing. Author

N71-36821# Bendix Corp., Kansas City, Mo. Dept. 835.
TRANSFER MOLDING OF CLOSE TOLERANCE PARTS Quarterly Report
R. J. Hishaw May 1971 32 p
(Contract AT(29-1)-613)
(BDX-613-283; QR-4) Avail: NTIS

In this phase of the analysis of transfer molding processes, the effects of conditional changes on the dimensions of molded parts were investigated. The purpose was to establish trends which can be expected as certain conditions are varied and to tabulate and graph the data to provide a basis for deriving expected shrinkage under known conditions. Mold temperature, transfer pressure, cure time, gate size, and cavity volume were varied individually as side-gated and end-gated parts were molded simultaneously. The deviation of each part from the cold mold dimensions, correlated with molding conditions for each part, provides the basis for the conclusions. Author

N71-36822# Bendix Corp., Kansas City, Mo.
ELECTROFORMED GILDING METAL ROTATING BAND
R. A. Hines May 1971 29 p refs
(Contract AT(29-1)-613)
(BDX-613-236) Avail: NTIS

A plating technique has been developed for electroforming gilding metal rotating bands used with the 155mm artillery shell. The method involves vapor blasting, silver plating, and heat treating the titanium shell. The gilding metal bands can then be electroformed on to the silver surface. Deposit roughness is still a problem area, and additional development is required to obtain a smooth plate. Author (NSA)

N71-36823# Bendix Corp., Kansas City, Mo.
ALUMINUM PULSE-ARC WELDING Quarterly Report
D. L. Hollar Mar. 1971 25 p
(Contract AT(29-1)-613)
(BDX-613-320; QR-FY-71-2) Avail: NTIS

A pulse-arc welding process was investigated to overcome a necking problem which is often encountered when joining multistrand aluminum wires by that method. Necking results in severance of some of the strands, causing an increase in joint resistance and a loss of joint strength. Preheating and post-heating the cover gas, weld fixture, and piece part to slow the heating and cooling of the weld joint did not substantiate the conjecture that rapid heating and cooling might be the cause of the problem. In fact, necking was more severe in heated welds than in those that were not preheated and post-heated. Author

N71-36824# Battelle Memorial Inst., Columbus, Ohio.
AN INVESTIGATION OF IMPROVED WELDED BELLOWS FOR POSITIVE EXPULSION APPLICATIONS Final

Summary Report, Mar. 1970 - Jun. 1971
L. E. Hulbert, N. D. Ghadiali, F. A. Simonen, and J. V. Baum
Jun. 1971 74 p refs
(Contract F04611-68-C-0031)
(AD-726523; AFRPL-TR-71-84) Avail: NTIS CSCL 13/13

An analytical and experimental program was conducted to determine whether the tilt-edge concept could be applied to the design of expulsion bellows. Such bellows must endure such large axial displacement that portions of the cross section are subjected to cyclic plastic strains. Expected cycle life is from 2,000 to 20,000 cycles. An analytical study was carried out using Battelle's computer codes NONLIN and NONLEP to determine bellows cross sections that gave low weld bead stresses and minimized the maximum stresses. A semi-elliptical cross section with 70 degrees edge tilt was found to give the best overall stress distributions. Although the selected design proved to be difficult to fabricate, bellows were made and tested in low cycle fatigue. The fatigue tests proved that the design did give satisfactory fatigue life performance, even though shell buckling was observed in the leaves. Author (GRA)

N71-36825# Catholic Univ. of America, Washington, D.C. Dept. of Civil and Mechanical Engineering.
AXIAL FATIGUE OF WIRE ROPE
S. R. Heller, Jr. and F. Matanzo 25 Jun. 1971 51 p refs
(Contract N00024-70-C-5439)
(AD-726457) Avail: NTIS CSCL 13/9

Axial fatigue tests in air were conducted on wire rope, strand, and single wires under the same load spectrum with an Amsler Vibrophore machine. The wire rope tests permitted a comparison of lend and regular construction with independent wire rope core (IWRC) and polypropylene core, showing lend IWRC to give the best performance. Results of single wire and strand tests do not agree well enough with the wire rope data to permit use of the wire or strand as predictors of rope performance. A possible frequency effect was noted in the strand tests and the lack of other wire rope data does not permit determining frequency effects in wire rope. Author (GRA)

N71-36826# Army Foreign Science and Technology Center, Charlottesville, Va.
EFFECT OF HIGH-TEMPERATURE THERMOMECHANICAL PROCESSING ON THE HEAT RESISTANCE OF THE ALLOY KhN70 VMTYu [VLYANIE VYSOKOTEMPERATURNOI TERMOMEKHANICHESKOI OBRABOTKI NA ZHAROPROCHNOST SPLAVA H70VMTYU]
M. G. Lozinskii et al 24 Jan. 1971 14 p refs Transl. into ENGLISH from the publ. "Struktura i Svoystva Zharoprochnykh Metaleicheskikh Materialov" USSR, 1967 p 270-276
(AD-726730; FSTC-HT-23-423-70) Avail: NTIS CSCL 13/8

One of the promising methods for hardening metals is high-temperature thermomechanical processing (HTMP); it involves a combination of hot plastic deformation and tempering. This paper gives some results of a study of the effects of various HTMP variants with the deformation of billets by drop-forging on the heat resistance of the alloy E1617 (KHn70VMTYu) with a nickel base. HTMP was performed using a crankshaft press with a maximum force of 2500 tons. Examination of many tests on variants reveals that the optimum HTMP variants for the alloy E1617 is forging at 1100-1050 C with settling by 9-12% and cooling of pretempered billets in the air. The results indicate that it is desirable to use HTMP in forging turbine blades from the alloy E1617. Author (GRA)

N71-36827# Allis-Chalmers Mfg. Co., Milwaukee, Wis. Advanced Technology Center.
DESIGN STUDY OF AN ALTERNATING-CURRENT ELECTRIC WHEEL Final Report, Jul. 1970 - Apr. 1971
William L. Ringland and Francis J. Enright Jun. 1971 102 p
(Contract DAAK02-70-C-0604)
(AD-726956; Rept-75014-PR-1049) Avail: NTIS CSCL 13/8

The purposes of this study were to determine the optimum alternating-current electric wheel suitable for military vehicles and to design it. The electric wheel was to have a nominal rating of 100 hp and would be used on both trucks and construction equipment vehicles. During the first part of the study, many electric-wheel concepts were considered: synchronous vs. induction motors, high-speed motors vs. low-speed motors, and gear shifts vs. fixed-ratio speed reducers. The most promising concept was selected, and its components were optimized. The optimum electric wheel was then designed in sufficient detail to illustrate the adequacy of the design and to permit the completion of design details and electric wheel manufacture at future date. The study resulted in an electric wheel consisting of a homopolar, inductor-type, sychronous motor driving the wheel through a two-stage, fixed ratio, planetary speed reducer. The electric-wheel assembly weighs approximately 2500 lb, and it fits inside the rim of a 26.5x25 tire. The design is within current state of the art, and the electric wheel can be built by conventional manufacturing procedures. Author (GRA)

N71-36828# Arcos Corp., Philadelphia, Pa.
DEVELOPING A HEAT-TREATABLE HY-80 WELDING ELECTRODE Final Report
Hallock C. Campbell 1 Jun. 1971 48 p
(Contract NObe-92490)
(AD-726758) Avail: NTIS CSCL 13/8

A heat-treatable low hydrogen electrode of MIL-9218 classification was developed, suitable for welds in 8-inch thick HY-80 steel to be quenched and tempered after welding. The electrode deposits weld metal with chemical composition slightly overmatching the composition of HY-80 steel. The electrode coating is similar to that of existing Arcos Ductilend electrodes which enjoy welder acceptance in shipyards and fabricating plants throughout the country. Samples of the electrode have successfully been used to weld HY-80 forgings 5-1/2 inches thick without entrapment of slag, or evidence of cracking or porosity. Operation of the electrode is satisfactory in all positions. Author (GRA)

N71-36829# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOME LAWS OF THE WEAR OF TOOL ELECTRODES DURING ELECTROMACHINING
M. A. Kalinin et al 19 Feb. 1971 11 p refs Transl. into ENGLISH from Izv. Vyshikh Uchebn. Zavedenii, Mashinostr. (Moscow), no. 1, 1970 p 148-151
(AD-726842; FTD-HT-23-63-71) Avail: NTIS CSCL 13/9

An analytical derivation is presented of mechanisms which govern the advancement rate of the interaction front of an electrode tool and the work piece in electroerosion machining, with particular applicability to tool wear and its effect on the shape and dimensional accuracy of machined cavities. Analysis showed that during the machining of a cavity, the current density depends on both the angle between the direction of feed and a normal to the electrode tool surface, and on the curvature at a given point. Maximum current density occurs at that point where a normal to the tool surface is parallel to the direction of tool feed. Using special equipment, current density for various spectors of the interaction front of electrodes was determined previously. The experimental data, with an error of no more than 7 percent, confirms the validity of the relationship derived for current density. Author (GRA)

N71-36830# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL INVESTIGATION OF SELF-ACTING-LIFT-PAD CHARACTERISTICS FOR MAIN-SHAFT SEAL APPLICATIONS
William F. Hady and Lawrence P. Ludwig Washington Oct. 1971 21 p refs
(NASA-TN-D-6394; E-6186) Avail: NTIS CSCL 11A

Experimental studies on four sstng lift geometries (shrouded step pads) for maintsining positive separation of seal surfaces are compared with theoretical calculations. Load capacities at measured film thicknesses were lower than those

predicted by theory for parallel surfaces. Sufficient gas (air) film stiffness was generated so that dynamic tracking of the seal seat face runout was maintained. Seal seat runouts to (0.0035 in.) were accommodated. Tracking, however, is inhibited during startup under light loads when seal seat runouts exceed 0.0025 cm (0.001 in.). Author

N71-38831# National Bureau of Standards, Washington, D.C. Mechanics Div.
UNIVERSAL TESTING MACHINE OF 12 MILLION lbf CAPACITY AT THE NATIONAL BUREAU OF STANDARDS
Final Report
Arthur F. Kirstein Sep. 1971 15 p refs
(NBS-SP-355) Avail: SOD $0.30

A twelve million pounds-force capacity universal testing machine is described. The machine, hydraulically operated with an overall height of over 100 feet, was designed to test full scale structural components and to apply the forces needed to calibrate large capacity force measuring devices. The testing machine is capable of applying axial forces of 12,000,000 lbf in compression, 6,000,000 lbf in tension, and a transverse force of 4,000,000 lbf to a flexural specimen. Author

N71-38832# Union Carbide Corp., Oak Ridge, Tenn.
PERFORMANCE EVALUATION OF PRECISION NUMERICALLY CONTROLLED TURNING EQUIPMENT
F. W. Jones 30 Apr. 1970 15 p Presented at 11th Intern. Machine Tool design and Res. Conf., Birmingham, England, 1-4 Sep. 1970
(Contract W-7405-eng-26)
(Y-NA-134; Conf-700958-1) Avail: NTIS

The approach used at the Oak Ridge Y-12 plant for developing specifications for numerically controlled metal turning lathes and the methods used for evaluating the performance of such precision lathes are described. NSA

N71-38833*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FRICTION AND WEAR OF COBALT-MOLYBDENUM AND COBALT-MOLYBDENUM-CHROMIUM ALLOYS FOR PROSTHETICS
Robert L. Johnson and Max A. Swikert Washington Oct. 1971 18 p refs
(NASA-TN-D-6512; E-6437) Avail: NTIS CSCL 11F

Studies were conducted in heptane with cobalt alloys on a disk-and-conforming-shoe apparatus simulating the single motion of a human hip joint. The results showed that cobalt-molybdenum-chromium alloys were brittle: that the surface finished fragmented locally by grinding and that, subsequently, abrasion of sliding surfaces occurred. When the ground surfaces were altered by glass-bead blasting, fragmentation during the wear process was minimized. Particles loosened by the grinding process were removed, and the bead-blasted surface provided pockets to entrap debris. Friction and wear for the bead-blasted cobalt-molybdenum-chromium alloy were significantly lower than for vitallium. Author

N71-38834*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ADHESION OF POLYMERS TO TUNGSTEN AS STUDIED BY FIELD ION MICROSCOPY
William A. Brainard and Donald H. Buckley Washington Oct. 1971 32 p refs
(NASA-TN-D-6524; E-6471) Avail: NTIS CSCL 11A

Mechanical contacts with polytetrafluoro ethylene (PTFE) and polyimide polymer (PI) contacting tungsten field ion microscope emitter tips were conducted in vacuum. The metal polymer interface was examined on an atomic scale by helium field ion microscopy. Mechanical transfer was observed upon simple touch contact of the polymer materials to tungsten. The transferred polymers were stable even at the high field necessary for helium ionization, thus implying a strong chemical bonding to the metal surface. The mechanical contact stresses orient the transferred material on the tungsten surface in a radial manner from the center of contact. With sufficient load the PTFE and PI cause deformation of the tungsten. On the tungsten (110) plane, individual molecular clusters can be resolved. Author

N71-38835# Safety in Mines Research Establishment, Buxton (England).
AUTOMATIC WIRE-SNAPPING MACHINE FOR THE STUDY OF INCENDIVE ELECTRICAL SPARKING
I. Turner 1970 14 p refs
(RR-267) Avail: NTIS

A review is given of early types of apparatus used to break wires carrying electric current in a flammable atmosphere, and the features desirable in a new machine are considered. The machine designed as a result of these considerations is described. It accommodates a range of sample sizes, and will automatically break a single sample or will recycle continuously. The machine was used for research into the factors affecting ignition of flammable gases by discharges produced in inductive circuits, but has not proved suitable for the routine testing of intrinsically safe equipment. Author

N71-38836# Grumman Aerospace Corp., Bethpage, N.Y. Materials and Structural Mechanics Section.
FUSION WELDING OF TITANIUM-TUNGSTEN AND TITANIUM-GRAPHITE COMPOSITES
James R. Kennedy Oct. 1971 46 p refs
(RM-519) Avail: NTIS

Fusion welding experiments were conducted on two titanium matrix composite systems: titanium-tungsten wire and titanium-graphite filament. The weldability of model composites and the influence of weld thermal energy on fiber-matrix reactions were investigated. Results of mechanized and manual gas-tungsten arc welding tests indicated that well diffusion bonded composites generally presented no unusual problems during fusion. The extent of fiber-matrix reactions in both systems was directly proportional to welding energy input. As energy input was increased, tungsten wire dissolution became greater and titanium carbide formation around the graphite filaments grew thicker. Welding energy input thus becomes a significant factor in controlling the nature of fiber-matrix reaction products. Tensile properties of titanium-tungsten composites, both as-diffusion bonded and as-welded, are compared. Author

N71-38837 National Lending Library for Science and Technology, Boston Spa (England).
FRICTION AND WEAR STUDIES UNDER ULTRA HIGH VACUUM
H. E. Hintermann et al 20 Apr. 1971 11 p refs Transl. into ENGLISH from Swiss report
(NLL-RISLEY-Trans-2140-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The friction and wear behavior of antifriction bearings under high vacuum conditions is discussed. The ultrahigh vacuum apparatus is described. The technique for measuring the wear produced during the tests is reported. Friction and wear characteristics of soft materials having a potentially self-lubricating character are examined. Author

N71-38838 National Lending Library for Science and Technology, Boston Spa (England).
THE SEPARATION OF VERY FINE PARTICLES
C. Alt [1970] 9 p refs Transl. into ENGLISH from Chem.-Ing.-Tech. (West Germany), v. 41, no. 5/6, 1969 p 345-348
(NLL-CE-Trans-5364-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The industrial separation of very fine particles is discussed. Procedures for particle separation are presented as follows: (1) sedimentation, (2) filtration, and (3) electric charge. Advantages and disadvantages of the various techniques are described. Author

N71-36639 National Lending Library for Science and Technology, Boston Spa (England).
FLAME CUTTING OF ALUMINIUM, COPPER AND STAINLESS STEEL BY THE PLASMA CUTTING METHOD
Walter Wuich 1971 6 p Transl. into ENGLISH from Blech (West Germany), v. 16, no. 8, 1969 p 395-396
(NLL-OA-Trans-1108-(6196.3)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The application of plasma beams for cutting various metals is discussed. Metals which were involved in the cutting process are copper, aluminum, and stainless steel. Classification of materials as cuttable, conditionally cuttable, and uncuttable is described. The actual operation by which cutting takes place is analyzed. Author

N71-36777# McDonnell Aircraft Corp., St. Louis, Mo. Engineering Reliability.
TECHNIQUES OF SYSTEM RELIABILITY ESTIMATION, INCLUDING FAILURE EFFECT ANALYSIS (FAILURE CONSEQUENCE)
W. T. Sumerlin *In* AGARD Reliability of Avionics Systems Jul. 1971 28 p refs (See N71-36776 23-14)
Avail: NTIS

N71-36778# Radio Corp. of America, Moorestown, N.J.
CORRELATION BETWEEN ESTIMATION TESTS AND SYSTEM OPERATING DATA
M. M. Tall *In* AGARD Reliability of Avionics Systems Jul. 1971 9 p refs (See N71-36776 23-14)
Avail: NTIS

N71-36779# McDonnell Aircraft Corp., St. Louis, Mo. Engineering Reliability.
EFFECTIVENESS OF RELIABILITY PROGRAM ELEMENTS
W. T. Sumerlin *In* AGARD Reliability of Avionics Systems Jul. 1971 9 p (See N71-36776 23-14)
Avail: NTIS

N71-36780# Radio Corp. of America, Moorestown, N.J.
COST EFFECTIVENESS OF BUILT-IN TEST PROVISIONS
M. M. Tall *In* AGARD Reliability of Avionics Systems Jul. 1971 8 p refs (See N71-36776 23-14)
Avail: NTIS

N71-36781# Grumman Aerospace Corp., Bethpage, N.Y. Engineering Operations and Administration.
HIGH RELIABILITY DESIGN TECHNIQUES APPLIED TO THE LUNAR MODULE
J. J. Bussolini *In* AGARD Reliability of Avionics Systems Jul. 1971 34 p refs (See N71-36776 23-14)
Avail: NTIS

N71-36782# Siemens-Schuckertwerke A. G., Munich (West Germany).
TESTING THE RELIABILITY OF AVIONIC EQUIPMENT FOR SPACECRAFT APPLICATIONS
Guenter Vollhardt *In* AGARD Reliability of Avionics Systems Jul. 1971 10 p (See N71-36776 23-14)
Avail: NTIS

N71-36783# Grumman Aerospace Corp., Bethpage, N.Y. Engineering Operations and Administration.
METHODS OF SPECIFYING AND CONTROLLING DESIGN RELIABILITY
J. J. Bussolini *In* AGARD Reliability of Avionics Systems Jul. 1971 19 p refs (See N71-36776 23-14)
Avail: NTIS

N71-36784# Radio Corp. of America, Moorestown, N.J.
RELATIONSHIPS BETWEEN PROGRAM TEST AND USER SUPPORT COSTS
M. M. Tall *In* AGARD Reliability of Avionics Systems Jul. 1971 9 p refs (See N71-36776 23-14)
Avail: NTIS

N71-36785# McDonnell Aircraft Corp., St. Louis, Mo. Engineering Reliability.
SYSTEM OPERATIONAL CONSIDERATIONS AND THEIR RELATIONSHIP TO THE TEST PROCESS
W. T. Sumerlin *In* AGARD Reliability of Avionics Systems Jul. 1971 8 p refs (See N71-36776 23-14)
Avail: NTIS

N71-36787# Grumman Aerospace Corp., Bethpage, N.Y. Engineering Operations and Administration.
THE BENEFITS OF A TOTALLY INTEGRATED RELIABILITY TEST PROGRAM
J. J. Bussolini *In* AGARD Reliability of Avionics Systems Jul. 1971 21 p refs (See N71-36776 23-14)
Avail: NTIS

N71-36788# Royal Air Force, High Wycombe (England). Strike Command.
OPERATIONAL CONSIDERATIONS AND SYSTEMS RELIABILITY
B. E. Baker *In* AGARD Reliability of Avionics Systems Jul. 1971 7 p (See N71-36776 23-14)
Avail: NTIS

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N71-36840*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GEODETIC STUDIES BY LASER RANGING TO SATELLITES
David E. Smith, Ronald Kolenkiewicz, and Peter J. Dunn (Wolf Res. and Develop. Corp., Riverdale, Md.) Apr. 1971 25 p refs Presented at the 3d Intern. Symp. on Use of Artificial Satellites for Geodesy, Washington, D. C., Apr. 1971
(NASA-TM-X-65696; X-553-71-361) Avail: NTIS CSCL 20E

For three months in 1970, two Goddard Space Flight Center laser tracking systems were used in an experiment to detect the motion of the pole of rotation of the earth. One tracking station was located at Goddard Space Flight Center and the other was about 406 km due north near Seneca Lake in New York State. Over two hundred passes of the Beacon Explorer C spacecraft were observed as it passed between the two stations, fifty of which were simultaneous, and these data have been used to determine the orbital inclination of the spacecraft during the experiment. The analysis of the data from the experiment required the accurate determination of the relative positions of the two tracking stations and the identification of the perturbations to the spacecraft orbit, in particular, those due to the gravitational fields of the earth, sun and moon and those caused by the solid-earth tides. The results to date indicate that the current GSFC laser systems have the capability of determining intersite distances with a repeatability of about 25 centimeters and that a new value of the Love Number, K2, which represents the distortion of the earth's gravity field caused by the tidal deformation of the earth is 0.33 + or - 0.05. Author

N71-36841*# Techtran Corp., Glen Burnie, Md.
INVESTIGATION OF THE NATURE OF THE EMISSION SPECTRA OF SUBSTANCES OBTAINED BY LASER RADIATION [ISSLEDOVANIYE KHARAKTERA SPEKTROV ISPUSKANIYA VESHCHESTVA, POLUCHENNYKH POD VOZDEYSTVIYEM IZLUCHENNYA OPTICHESKOGO KVANTOVOGO GENERATORA (OKT)]
A. I. Korunchikov et al Washington NASA Oct. 1971 7 p refs Transl. into ENGLISH from Spektroscopiya, Tr. Sib. Soveshch. (Moscow), 1969 p 224-226
(Contract NASw-2037)
(NASA-TT-F-13967) Avail: NTIS CSCL 20E

Conditions were investigated under which the excitation caused by laser radiation could be changed. It was found that lowering atmospheric pressure ambient to the sample at the moment of its irradiation by laser considerably changed the nature of spectral lines. On the other hand the changes of energies of the laser beam and of the focal distance had a slighter effect on the characteristics of the spectra. Author

N71-36842# National Bureau of Standards, Boulder, Colo.
DATA ANALYSIS FOR ISOPERIBOL LASER CALORIMETRY
E. D. West Feb. 1971 27 p refs
(ARPA Order 891)
(AD-726514; NBS-TN-396) Avail: NTIS CSCL 14/2

Isoperibol calorimeters (those operating in a constant-temperature environment) are used to measure the power and energy in laser beams relative to electrical standards. The derivation of the basic formula is reviewed. Two methods are presented for analyzing the data taken at equal time intervals: (1) an approximate manual method with criteria for avoiding significant errors of approximation and (2) a least squares method for use with automatic digital computers. Author (GRA)

N71-36843# Perkin-Elmer Corp., Wilton, Conn.
ELECTROSTRICTIVE SELF-TRAPPING OF PICOSECOND LASER PULSE TRAINS
Edwin L. Kerr Mar. 1971 14 p refs
(Contract F19628-69-C-0220)
(AD-726522; PE-10633; SR-2; AFCRL-71-0199) Avail: NTIS CSCL 20/6

A nanosecond-long train of picosecond laser pulses theoretically can produce self-focusing and trapping by electrostriction, even though the trapping threshold for a single picosecond pulse is very high. The relative roles of electrostriction and various types of Kerr effect in picosecond pulse train trapping should be assessed. Author (GRA)

N71-36844# Illinois Univ., Urbana. Coordinated Science Lab.
RADIATION EFFECTS IN SEMICONDUCTING LASER MATERIALS Final Report, Jan. 1970 - Jan. 1971
B. M. Arora Mar. 1971 45 p refs
(Contract F33615-69-C-1251)
(AD-727061; ARL-71-0064) Avail: NTIS CSCL 20/12

Luminescence of pure CdSe, CdS and CdSSe has been investigated in the temperature range from about 6 K to 80 K. At low temperature, the stimulated luminescence of a CdSe platelet consists of several laser peaks depending upon the platelet under study and the level of its excitation. Some of the laser peaks appear to be correlated to the spontaneous lines seen in our measurements, and reported as well as interpreted by other investigators. Irradiation of CdSe platelets with fast neutrons introduces new laser lines which are shifted towards longer wavelengths. These results are interpreted in terms of the decay of excitons bound to defects. Some effects of chemical doping have also been investigated. Broad band edge emission, which is absent in the pure crystals, appears very strong on doping CdS and CdSe with NaCl. This suggests that Na and Cl are the impurities responsible for the pair emission, which is consistent with the suggestion of Henry and Thomas that Na acts as an acceptor and Cl as a donor in these materials.
Author (GRA)

N71-36845# ARO, Inc., Arnold Air Force Station, Tenn.
LASER DOPPLER VELOCIMETER DUAL SCATTER PROBE VOLUME Final Report, Jul. - Oct. 1970
W. H. Goethert AEDC Jul. 1971 40 p refs
(Contract F40600-72-C-0003)
(AD-727005; AEDC-TR-71-85; ARO-OMD-TR-71-24) Avail: NTIS CSCL 14/2

A further clarification of the volume from which data originate in the dual scatter laser Doppler velocimeter is presented. Several factors are noted that specify the primary dimensions of the probe volume which in some cases are totally specified by the collector optics. It was found experimentally that the lens aperture of the light collecting optics has a primary effect on the volume from which data originate. An equation is derived for reducing this data volume for both the on-axis and off-axis cases. Experimental verification is presented and compared to the derived equation. Author (GRA)

N71-36846*# Scientific Translation Service, Santa Barbara, Calif.
DIFFERENCE FREQUENCY GENERATION BY NONLINEAR OPTICS METHODS [GENERATSIYA RAZNOSTNOY CHASTOTY METODAMI NELINEYNOY OPTIKI]
S. G. Karpenko et al Washington NASA Oct. 1971 13 p refs Transl. into ENGLISH from Zh. Prikl. Spektroskopii, Akad. Nauk Belorussk. SSR (Minsk), v. 12, no. 5, May 1970 p 861-867
(Contract NASW-2035)
(NASA-TT-F-13979) Avail: NTIS CSCL 20E

A theoretical investigation is presented of the conversion of optical emission from powerful solid-state lasers into the far infrared region by means of nonlinear polarization with the generation of a small difference frequency. It is shown that the spatial divergence of the input radiation is very significant, and the surface brightness of the output face of the crystal is determined at the difference frequency. Attention is given to cases of emission under conditions of phase synchronization and without synchronization. In the first case, the emitted radiation is concentrated within an interval of angles up to several degrees, while in the second case it is distributed in practically all directions with the crystal's edge surface brightness weakly dependent on the output angle. It is shown that the use of giant-pulse Lasers can result in emission in the far infrared at power levels of 10 W or more. Author

N71-36847# Rochester Univ., N.Y. Inst. of Optics.
SOME METHODS FOR GENERATING TUNABLE LASER EMISSION Final Report, 15 Nov. 1967 - 15 Nov. 1970
Michael Hercher Jun. 1971 30 p refs
(Contract F19628-68-C-0124)
(AD-726659; AFCRL-71-0284) Avail: NTIS CSCL 20/5

The program had as its goal the study of methods for obtaining high power coherent emission at a variety of wavelengths, using conventional lasers as primary sources. Conversion techniques included stimulated Raman scattering, sum frequency generation and combinations of the two--using Q-switched and CW Nd:YAG lasers as sources. A number of wavelengths in the visible were generated at peak powers of 10 to 100 KW by first generating stimulated Raman emission, and then second harmonics and sums of the Raman lines. The second phase of the program involved organic dye lasers (mainly rhodamine 6G). Both laser-pumped dye lasers and flashlamp-pumped dye systems were studied experimentally. A flashlamp pumped dye laser was operated in a single mode which could be tuned from 4400A-5000A(7-diethylamino 4-methyl dye); 5200-5600A(fluorescein dye); and 5600-6500A(rhodamine 6G dye) at a peak power of several KW in microsec. pulses at 30 pps. A transverse-flow dye laser capable of KHz operation was built and will soon be tested. Work in this area recently culminated in a continuous, tunable dye laser (150 mW; tuning range 5230A to 6560A) pumped by a 2 watt argon ion laser.
Author (GRA)

N71-38848# Defence Standards Labs., Maribyrnong (Australia).
IONIZATION RATE IN CARBON DIOXIDE LASER GAS MIXTURES
C. H. H. Carmichael May 1971 15 p refs
(Rept-442) Avail: NTIS

Ionization rate has been measured in a glow discharge in CO2-N2-He gas mixtures commonly used in carbon dioxide lasers, covering the range 65% to 95% helium content. Results are presented in graphical form and are also fitted to an analytical expression which reveals the relevance of the measurements to the problem of glow-to-arc transition in these gas mixtures. Author

N71-38849# Princeton Univ., N.J. Plasma Physics Lab.
USE OF LONG-WAVELENGTH, HIGH-POWERED LASERS FOR CONTROLLED THERMONUCLEAR FUSION
J. M. Dawson, A. Hertzberg, R. E. Kidder, G. C. Vlases, H. G. Ahlstrom et al 17 Jun. 1971 14 p refs Presented at the 4th Conf. on Plasma Phys. and Controlled Nuclear Fusion Res., Madison, Wis., 17 Jun. 1971
(Contracts AT(30-1)-1238; NSF GK-28562)
(Conf-710607-48; CN-28/D-13) Avail: NTIS

The possibilities of applying relatively long-wavelength lasers to the problems of obtaining controlled thermonuclear reactions are discussed. In particular, the very attractive possibilities opened up by the recent development of high-powered, high-efficiency 10.6 microns N2-CO2 lasers are examined. The lasers can effectively heat plasmas in the density range of 10 to the 17th power to 10 to the 19th power particles/cm 3 to thermonuclear temperatures. Absorption lengths for 10 microns radiation range from a few tens of centimeters to a few kilometers, depending on density and temperature; calculations show that the laser beam will be self-focusing and thus confined to the plasma. Such plasmas can be confined by available magnetic fields; for the lower densities, fields of 200 to 300 kG are required, while at the higher densities, fields of 2 to 3 MG are needed. A number of reactor possibilities are considered. Author (NSA)

N71-38850 California Univ., San Diego.
LASER-INDUCED INSTABILITIES IN LIQUIDS AND GASES, 1. HYDRODYNAMICS EFFECTS ON THE LASER-BEAM PROPAGATION THROUGH GLASS, 2
Sadanand Sakharam Rangnekar (Ph.D. Thesis) 1970 214 p
Avail: Univ. Microfilms Order No. 70-18320

The laser-induced instabilities liquids and gases were studied. The theory used is the macroscopic, linearized instability theory developed by Bureetner and Jorna. The processes through which the laser-beam interacts with the media are: electrostriction, thermal energy depoeition, Kerr effect, and the stimulated Raman scattering. The growth rates for the various possible unstable modes in carbon disulfide, benezene, and air are obtained by analyzing the dispersion relation analytically and numerically. A second study was devoted to the hydrodynamic effects on the laser-beam propagation through gases. The equations of hydrodynamics and the equations of the ray-path are solved numerically by using the finite difference scheme. The possibility of the hydrodynamic and the optical instabilities are eliminated by the choice of the von Neumann stability condition and by the proper distribution of the flux. Dissert. Abstr.

N71-38851 Tennessee Univ., Knoxville.
REAL-TIME VISUAL RECONSTRUCTION OF INFRARED HOLOGRAMS
William Alexander Simpson, Jr. (Ph.D. Thesis) 1969 105 p
Avail: Univ. Microfilms Order No. 70-17847

A method is described of producing holograms in the infrared region of the spectrum utilizing a cholesteric liquid crystal medium. The holograms are then reconstructed in real-time using a helium-neon laser. That portion of the theory of holography and lasers which is applicable in the present case is given, and the design of the apparatus is seen to follow logically from this theory. A description of the design parameters of the carbon dioxide laser used in recording the holograms is given, and it is shown that the output of the laser occurs in the fundamental transverse mode and on a single longitudinal mode. The fabrication of the recording medium is then described, and it is shown that satisfactory results can be obtained by sandwiching the cholesteric material between glass and sodium chloride plates. It is shown that the recording medium is capable of storing interference patterns with grating constants as fine as 26 microns, and that the persistence of the reconstructed image is about five seconds. Dissert. Abstr.

N71-38852 Stanford Univ., Calif.
THE OPTICAL RESPONSE OF A LASER-DOPPLER SENSING INSTRUMENT IN MEASUREMENTS OF HIGH VELOCITY PARTICLE-ENTRAINING FLOWS
Barclay Jamison Tullis (Ph.D. Thesis) 1970 254 p
Avail: Univ. Microfilms Order No. 70-18480

Technique of remote particle sensing is described. This technique has been experimentally developed and proven in a prototype field instrument called a laser-Doppler particle sensor. Its essential components are: (1) a single-frequency-laser light source, (2) a probe lens which both focuses the laser light into a high intensity, microscopic focal volume and collects portions of light scattered by particles passing through the focal volume, (3) a scanning Fabry-Perot interferometer which functions as a selective frequency filter to search for single-particle signal pulses within a spectrum of Doppler-shifted light frequencies, and (4) one or more photomultipliers with associated electronics for detecting signal pulses transmitted by the interferometer and recording their amplitudes and occurrence rates as functions of velocity (Doppler shift). Dissert. Abstr.

N71-38853 Stanford Univ., Calif.
VISIBLE CW OPTICAL PARAMETRIC OSCILLATIONS
James Forrest Young (Ph.D. Thesis) 1970 84 p
Avail: Univ. Microfilms Order No. 70-16812

Research directed toward developing CW, tunable, coherent optical sources is reported. The index of refraction inhomogeneities of lithium niobate crystals are described and are explained in terms of the phase diagram of the Li2O - Nb2O5 system. The test procedures and growth technique which led to high-quality, long crystals are presented. Using such a crystal the first visible CW optical parametric oscillator was constructed. The oscillator was pumped with the 0.5145 micron multimode power of an argon ion laser and was thermally tuned from 0.68 microns to 0.705 microns at the signal, and 2.11 microns to 1.90 microns at the idler. Both signal and idler waves were resonated. Average signal powers of 2 mW were measured in a 3/cm bandwidth. A similar oscillator was built using a three-mirror ring resonator which exhibited improved stability and conversion. An unsuccessful attempt to construct an optical parametric oscillator internal to an argon ion laser using barium sodium niobate is also described. Author

N71-38854 Tufts Univ., Boston, Mass.
A NEW METHOD FOR CALCULATING LASER MODES IN THE LARGE FRESNEL NUMBER LIMIT
Frank Patrick Battles (Ph.D. Thesis) 1969 196 p
Avail: Univ. Microfilms Order No. 70-17996

A new method of calculating the resonant modes and eigenvalues of a laser cavity as determined by diffraction in the limit of large Fresnel number was developed. In this limit is converted the usual integral equation formulation of this problem into a differential equation which is very similar in form to the Schrodinger equation. In this equation, the mass of the particle and Planck's constant are introduced, and the potential which the particle feels is determined by the departure of the mirror from planarity. The solution to this Schrodinger-like equation gives the transverse field distribution on the mirror surface. Then it is shown how a boundary condition can be obtained from the integral equation. This enables the eigenvalues to be determined. This formalism is first applied to hole coupled circular plane parallel mirrors. Then two of the standard approximation

techniques of quantum mechanics, perturbation theory and the W.K.B. method, are applied to various resonators. Dissert. Abstr.

N71-36855 Rochester Univ., N.Y.
A STUDY OF THE NEODYMIUM-YAG LASER AND TWO METHODS OF FREQUENCY CONVERSION
John Everett Gallagher (Ph.D. Thesis) 1970 360 p
Avail: Univ. Microfilms Order No. 70-17880

A detailed study of the neodymium-YAG laser and a description of two methods for converting its infrared output to visible radiation are presented. Primary emphasis is given to the continuous laser pumped with tungsten-halogen incandescent lamps. Intracavity harmonic generation using lithium niobate or barium sodium niobate is examined, both theoretically and experimentally. A second method of frequency conversion, suitable for use with high power pulsed q-switched lasers, combines the stimulated Raman effect and harmonic or sum frequency generation. This technique is examined experimentally. The design of continuously-pumped neodymium-YAG lasers is discussed. A theoretical model for the laser is presented, and the system parameters so defined - output coupling, pumping, gain, and gain saturation - are measured for three laser crystals and two pumping lamps. Dissert. Abstr.

N71-36856 California Univ., Berkeley.
THERMAL INTERACTION OF LASER BEAMS WITH LOW ABSORBING MATERIALS
Franklin Winston Dabby (Ph.D. Thesis) 1969 125 p
Avail: Univ. Microfilms Order No. 70-17542

The interaction of a laser beam with a thermal medium is studied. A unified analytic treatment of the interaction is presented for short cells and extended media in both steady state and time-varying situations. Predicted phenomena include beam trapping, self-induced frequency modulation, lens effects, and beam aberration. Comparisons are made between experimental results and theoretical predictions. The experiments reported deal with CW thermal self-focusing, 20 microsecond thermal lenses, beam aberration, beam trapping of 30 micron diameter laser beam, self-induced frequency modulation (as high as 250 KHz), and chirping. The agreement with theory is good. Possible future uses of the interaction are presented. The topics covered are self-induced frequency modulation causing 100 A wavelength shifts at optical frequencies, C.W. Raman scattering, and spatial side band generation. Dissert Abstr.

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N71-36857*# Techtran Corp., Glen Burnie, Md.
ON TETRAGONAL FERROPLATINUM FROM THE NORIL'SK DEPOSITS
A. D. Genkin et al Washington NASA Oct. 1971 9 p refs Transl. into ENGLISH from Tr. Mineralog. Muzeya, Akad. Nauk SSR (Moscow), no. 16, 1965 p 209-214
(Contract NASw-2037)
(NASA-TT-F-13966) Avail: NTIS CSCL 11F

Chemical and X-ray studies of samples of ferroplatinum found in a chalcopyrite vein in Noril'sk mines are conducted. The unique form of ferroplatinum fillings is described. The chemical analysis of the sample revealed a high content of iron and a close resemblance to the Ural ferroplatinum. An original method of X-ray photography produced sufficiently intense lines and convinced the authors that the mineral under study was ferroplatinum of tetragonal structure. Author

N71-36858*# Techtran Corp., Glen Burnie, Md.
RATIO OF LIQUID AND GASEOUS PHASES DURING THE ACTION OF FOCUSED LASER RADIATION ON METALS [SOOTNOSHENIYE ZHIDKOY I GAZOOBRAZNOY FAZ PRI VOZDEYSTVII SFOKUSIROVANNOGO IZLUCHENIYA OKG NA METALLY]
V. M. Kirillov et al Washington NASA Sep. 1971 10 p refs Transl. into ENGLISH from Fiz. Khim. Obrab. Mater. (Moscow), no. 1, 1971 p 8-12
(Contract NASw-2037)
(NASA-TT-F-13908) Avail: NTIS CSCL 11F

An approximate calculation of the phase composition of the product of destruction of a metal by focused laser radiation and its changes during the light pulse is performed. For many metals, the mass of the vapor ejected from the pit per pulse is approximately an order less than the mass of the molten material. The method of irradiating the rotating sample was used to separate the products of destruction into the gaseous and liquid phases. Author

N71-36859*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CORRELATION OF IRRADIATION DATA USING ACTIVATION FLUENCES AND IRRADIATION TEMPERATURE
John H. Lynch 1971 15 p refs Presented at the Am. Nucl. Soc. Winter Meeting, Miami Beach, Fla., 17-21 Oct. 1971
(NASA-TM-X-67898; E-6493) Avail: NTIS CSCL 11F

Nil-ductility transition temperature data for A302-B ferritic steel were analyzed by using multiple regression. Four independent variables were used. These were specimen temperature during irradiation and time-integrated specific activations (activation fluences) of fast-, intermediate-, and thermal-neutron detectors. The results of these analyses were predictive equations having the increase in transition temperature as the dependent variable. For a reference point, a similar analysis was also performed using the flux integral above 1 MeV and the irradiation temperature as independent variables. Also, the effects of excluding irradiation temperature from these analyses was studied. The results of these analyses showed that excellent correlation was achieved by using activation fluences and irradiation temperature as the independent variables; that is, 93 percent of the data variability was explained as contrasted with 36 percent when using the flux above one MeV. Irradiation temperature was found to account for from 29 to 46 percent of the data variability depending on the model used. The activation fluence model was also compared with a selected damage function model. This comparison indicated that the activation fluence method was about as accurate (for the data studied) as the damage function method, and had several additional advantages over this method. Author

N71-36860*# Translation Consultants, Ltd., Arlington, Va.
NEW DATA ON VRBAITE AND ITS MERCURY CONTENT [NOUVELLES DONNEES SUR LA VRBAITE SA TENEUREN MERCURE]
R. Caye et al Washington NASA Oct. 1971 11 p refs Transl. into ENGLISH from Bull. Soc. Franc. Mineral. Cryst. (Paris), v. 90, 1967 p 185-191
(Contract NASw-2038)
(NASA-TT-F-13759) Avail: NTIS CSCL 11F

Qualitative tests showed that mercury is an essential constituent of vrbaite. By electron probe microanalysis the following formula is deduced: Ti4Hg3Sb2As8S20. These results are discussed. The mineral description is completed by X-ray powder diagrams and by a study of reflectivity as a function of wavelength in visible light. Author

N71-36861*# Boeing Scientific Research Labs., Seattle, Wash. Material and Structural Sciences Lab.
STRESS CORROSION CRACKING OF TITANIUM ALLOYS: STUDIES OF CRACKS IN THIN SPECIMENS; SCC OF Ti-6Al-4V IN CHLORIDE, IODIDE AND FLUORIDE SOLUTIONS; STRESS CORROSION CRACKING IN

MOLTEN SALTS; ELECTROCHEMISTRY OF FRESHLY GENERATED TITANIUM SURFACES Quarterly Progress Report, 1 Apr. - 30 Jun. 1971
T. R. Beck, M. J. Blackburn, and W. H. Smyrl 30 Jun. 1971 159 p refs
(Contract NAS7-489)
(NASA-CR-122939; QPR-20) Avail: NTIS CSCL 11D

Research papers and technical discussions are presented of studies conducted on stress corrosion cracking in aqueous solutions and molten salts, and on the kinetics of new titanium surfaces. In the research with molten salts, data are given on stress corrosion cracking of Ti6-1-1 in LiCl-KCl melts at different temperatures, and for three different heat treatments. Experiments were conducted to determine the influence of hydrogen, with results which indicated no importance of H(±), H2, or H(-) in the cracking mechanism. The implications of an anodic dissolution mechanism and an adsorption mechanism are discussed. Two experiments are reported on the electrochemistry of freshly-generated titanium surfaces; one in which a rotating disk of titanium was scraped with a sapphire cutter in HCl solution, and the other in which titanium specimens were rapidly fractured in solution under potentiostatic conditions and current density was measured as a function of time. D.L.G.

N71-36862*# McDonnell-Douglas Astronautics Co., Newport Beach, Calif.
STRESS CORROSION CRACKING OF TITANIUM ALLOYS AT AMBIENT TEMPERATURE IN AQUEOUS SOLUTIONS
Yearly Summary Report, Sep. 1969 - Sep. 1970
Theron L. Mackay Sep. 1970 32 p refs
(Contract NAS7-488)
(NASA-CR-122935; SM-49105-F4) Avail: NTIS CSCL 11F

The effect of aluminum concentrations on the stress corrosion susceptibility of alpha-titanium in aqueous 3-percent NaCl salt environments at ambient temperature was studied. Five experimental alloys with aluminum concentrations from 5.0 to 7.0 weight percent were tested in equiaxed and quenched alpha-phase microstructures. Susceptibility to stress corrosion cracking was found to increase very rapidly above 5.5 weight percent Al. The coplanar prism slip observed with increasing aluminum concentration is primarily responsible for stress-corrosion crack initiation, while decreasing stack fault energy with increasing aluminum concentration explains the basal- or near basal-plane cleavage observed in stress corrosion cracking of alpha and alpha-beta titanium alloys. An analysis was made of the effect of a stress field at 450 F and 600 F precipitation of hydrides in pure titanium containg 0.76 percent hydrogen showed that dislocations introduced into the alpha-titanium during the stressing cycle served as nucleation sites for gamma hydride precipitates during the quenching cycle. Author

N71-36863# Bureau of Mines, College Park, Md.
CHEMICAL SPOT TESTS FOR ALUMINUM ALLOYS
A. W. Maynard and D. A. Wilson Aug. 1971 18 p refs
(BM-RI-7544) Avail: NTIS

Simple chemical spot tests for the identification of major alloying elements in aluminum-base alloys are described. The tests are suitable for use by nontechnical personnel working outside a laboratory. Use of electrographic sampling in a test for magnesium in aluminum is made possible by using glass fiber filter paper. Differentiations between magnesium and magnesium-silicon alloys of aluminum and between aluminum-base and magnesium-base alloys are made by direct chemical solution tests. Description of a device for obtaining reliable electrographic samples is included. A sequence of testing for identification by alloy groups is given. Author

N71-36864# Cornell Univ., Ithaca, N.Y. Dept. of Materials Science and Engineering.
DEFECT STRUCTURE OF DEPLETED ZONES IN IRRADIATED TUNGSTEN
L. A. Beevan, R. M. Scanlan, and D. N. Seidman 22 Mar. 1971 28 p refs Sponsored in part by ARPA
(Contract AT(30-1)-3504-50)
(NYO-3504-50) Avail: NTIS

A quantitative field ion microscope study was made of the defect of two depleted zones detected in high purity tungsten specimens irradiated in situ under ultrahigh vacuum conditions at a specimen temperature of 18 K with 20 keV tungsten(+) ions to a dose of approximately 1 x 10 to the 13th power tungsten(+) ions/sq cm. The irradiated specimens were examined by the pulsed-field evaporation technique at 18 K, hence their structure is characteristic of this temperature. The SIAs found locally were on the peripheral surfaces of the depleted zones. In addition to the large local imbalance in point defect concentrations, the depleted zones were elongated along < 011 > directions. It was found that each of the depleted zones was created by a single incident ion, and a comparison of the number of displaced atoms in each zone with the value predicted by the Kinchin-Pease model showed that this model overestimates strongly the number of displacements created per incident ion. Author (NSA)

N71-36865# California Univ., Livermore. Lawrence Radiation Lab.
RADIATION DAMAGE FROM INTERNAL ALPHA DECAY IN THORIUM
Dorn Schmidt (Ph.D. Thesis) Feb. 1971 93 p refs
(Contract W-7405-eng-48)
(UCRL-51009) Avail: NTIS

A technique was investigated for producing radiation damage in metals by homogeneously doping the metal (in this case thorium) with some short lived atomic species whose decay produces sufficient radiation damage to permit study by conventional techniques. The relative advantages and disadvantages are discussed. Radiation damage was accumulated at 4.2 K, and a rough isochronal anneal covering the temperature range 4.2 to 1150 K was performed. Additional isochronal and isothermal recovery studies were performed in the temperature range 4.2 to 80 K. The upper boundaries of the various stages are as follows: Stage I (48 K), Stage II (230 K), Stage III (400 K), Stage IV (1100 K). Total Stage I recovery was only 30%. Stage I was found to have five substages with assignments of substage sources being the same as in copper. Long range interstitial migration in Stage I sub E was clearly demonstrated, but distinction between various interstitial models was not possible. Activation energies were determined for several stages. Author (NSA)

N71-36866# Compagnie Francaise Thomson Houston-Hotchkiss Brandt, Paris.
METALLURGY OF SUPERCONDUCTORS. NEW SUPERCONDUCTING MATERIALS AND SOME DEVELOPMENTS [METALLURGIE DES SUPRACONDUCTEURS. NOUVEAUX MATERIAUX SUPRACONDUCTEURS ET QUELQUES REALISATIONS]
J. M. Blanc 1970 30 p refs In FRENCH Presented at Panel on Superconductors, Paris, 17 Mar. 1970
(Conf-700341-7) Avail: AEC Depository Libraries

The fundamental properties of superconductors are reviewed, enumerating the different categories of superconductors. Among the industrial superconductors, particular attention is given to the alloy Nb-Ti and the intermetallic compound Nb3Sn. The manufacturing process and methods of stabilization employed in the production of Nb-Ti are presented: use of a conducting matrix, hollow conductor, and intrinsic stabilization. The physical properties of Nb3Sn are described and the processes whereby the tin is diffused into the niobium are discussed. The mechanical and superconducting properties obtained are described. NSA

N71-36867# Oak Ridge National Lab., Tenn.
MEASUREMENT OF THE CONCENTRATION OF OXYGEN DISSOLVED IN TANTALUM
A. M. Anuchkin, A. K. Volkov, I. N. Kidin, T. M. Rozhnova, and M. A. Shtremel Jan. 1970 4 p refs Transl. into ENGLISH

from Izv. Vyssh. Uchsb. Zaved., Chem. Met. (Moscow), v. 13, no. 1, Jan. 1970 p 140-142
(ORNL-tr-2479) Avail: NTIS

Concentrations of solid solution Ta-O were measured in relation to the ratios of electric conductivity at room temperature and at 77 K. The dimensions or deformations of specimens did not influence the kappa magnitude. According to the Matthiessen law the Z = 1/(kappa-l) was in linear relationship with C concentrations. Twelve sets with 206 specimens, containing 0.04 to 9.99% O were measured for kappa, rhO, and lattice alpha after annealing at 1800 C. For one phase, alloys with C < or = 3.5 at. % O were found. Author (NSA)

N71-36868# California Inst. of Tech., Pasadena.
MAGNETIC STATES IN AMORPHOUS Pd41Ni41B18 ALLOYS CONTAINING CHROMIUM AND IRON
Victor K. C. Liang (Ph.D. Thesis) 1971 168 p refs Sponsored in part by AEC
Avail: NTIS

Amorphous alloys Pd41Ni41B18 containing up to 4 at.% of Cr or Fe were obtained by rapid quenching from the liquid state. The electrical resistivity of these alloys was measured as a function of concentration and temperature in order to gain some understanding of the effect of spin correlation on electronic conduction in amorphous solids. The resistivity vs. temperature curve for the amorphous alloys containing Cr exhibit all the characteristics of a Kondo system. An excellent agreement is found between the present resistivity data and Hamann's theoretical prediction. It is shown that the resistivity of all the Cr alloys studied can be adequately represented by a universal function of reduced temperature which is defined as the ratio of temperature to Kondo temperature. The experimental results are used to make a comparison between the Kondo theory and the Hamann theory. The latter is found to be superior to the former. Author

N71-36869# Wisconsin Univ., Madison. Dept. of Minerals and Metals Engineering.
CREEP IN STOICHIOMETRIC BETA NiAl
P. R. Strutt (Conn. Univ., Storrs), G. M. Rowe (Conn. Univ., Storrs), and R. A. Dodd Apr. 1971 5 p refs Presented at the 2nd Conf. on the Strength of Metals and Alloys, Pacific Grove, Calif., 30 Aug. 1970
(Contracts AT(11-1)-1489; F44620-69-C-0011; Grant NSF GK-20412)
(COO-1489-10; Conf-700819-12) Avail: NTIS

A summary of the creep properties beta-NiAl is given. Results of electron microscopy studies of thin film specimens sectioned from deformed crystals are briefly described. J.G.M.

N71-36870# Aeronautical Research Labs., Melbourne (Australia).
THE EFFECTS OF RE-SOLUTION TREATMENT AND OVERHEAT ON THE FATIGUE PROPERTIES OF D.T.D. 683/3 ALUMINIUM ALLOY BAR
F. G. Harris and R. W. Rowan Jan. 1971 38 p refs
(ARL/SM-note-258) Avail: NTIS

Unnotched and notched rotating cantilever fatigue tests were carried out on specimens made from D.T.D. 683/3 aluminium alloy bar in the as received, resolution treated and aged, and overheated and aged conditions. The results indicated that: (1) When compared with the as received material, resolution treatment decreases the fatigue strength at 10 to 8th power cycles by approximately 10% for unnotched material and 25% in the case of notched material. (2) Overheating (during solution treatment) of up to 60 C above the specification temperature has no significant effect on the fatigue and tensile properties of the alloy when compared with those of the resolution treated material. (3) Severe overheating (90 C above the specification temperature) causes severe grain boundary melting, a 30% reduction in ultimate tensile strength and reduction in unnotched fatigue strength of up to 70% when compared with resolution treated material. Author

N71-36871# Florida Univ., Gainesville. Dept. of Metallurgical and Materials Engineering.
DIFFUSION COMPOSITION PATH PATTERNS IN TERNARY SYSTEMS
Robert J. De Hoff, J. K. Anusavice, C. C. Wan, and Albert G. Guy Feb. 1971 70 p refs
(Contract N00014-68-A-0173-0011)
(AD-726458) Avail: NTIS CSCL 11/6

A new viewpoint on the analysis of diffusion behavior in ternary systems is presented, in which the matrix of diffusion coefficients is replaced by the relative penetration tendencies of the three species. This approximate but physical approach is combined with a linear approximation description of concentration-penetration curves for individual species in diffusion couples. This procedure makes the calculation of the diffusion path and Kirkendall shift for a given ternary couple very simple and straightforward; this in turn facilitates the calculation of a complete pattern of composition paths and Kirkendall shifts on the Gibbs triangle for any given model of relative penetration tendencies of the components. The availability of such patterns makes it easy to recognize and model the relative penetration tendencies in systems for which the composition path pattern has been experimentally determined. The approach is then successfully applied to generating relatively simple penetration tendency models which reproduce experimental composition path and Kirkendall shift patterns in Cu-Ni-Zn, Fe-Ni-Co, and Cu-Ag-Au. Author (GRA)

N71-36872# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN INVESTIGATION OF A MIXED PHASE EQUATION OF STATE FOR THE PUFF 66 COMPUTER CODE
William H. Barrett (M.S. Thesis) Jun. 1971 117 p refs
(AD-726892; GNE/PH/71-1) Avail: NTIS CSCL 20/11

A Mixed-Phase equation of state was programmed for the PUFF material response code and the behavior of 2024 aluminum was investigated. Identical PUFF problems were run on the CDC 6600 computer at the Air Force Weapons Laboratory to compare the existing and Mixed-Phase equations of state. The Mixed-Phase formulation is a more realistic representation of the response of materials to nuclear radition, but it predicts responses qualitatively similar to those predicted by the existing equation of state. Author (GRA)

N71-36873# Army Foreign Science and Technology Center, Charlottesville, Va.
HEAT RESISTANCE AND PHYSICOCHEMICAL PROPERTIES OF MULTICOMPONENT NICKEL ALLOYS [ZHAROPROCHNOST I FIZIKO-KHIMICHESKIE MNOGOKOMPONENTNYKH NILELEVYKH SPLAVOV]
L. A. Ryabtsev 4 Nov. 1970 12 p refs Transl. into ENGLISH from the Russian book
(AD-726733; FSTC-HT-23-432-70) Avail: NTIS CSCL 11/6

A study was made of the change of some physicochemical properties in alloys with a nickel base, beginning with two-component and ending with eight-component alloys. It is clear from an electron microscope analysis that a complication of the composition of the investigated alloys results in a decrease in the excess Gamma-phase, its more uniform distribution in the alloy and a greater uniformity throughout. The results of an X-ray spectral microanalysis indicated that the chemical composition of the Gamma-solid solution and the Gamma-phase is complicated by the introduction of additional components in the alloy. High-temperature electric resistivity increases with an increase in the aluminum content in the alloys, as well as with a complication of their composition. The linear coefficient of thermal expansion of alloys decreases with a transition from the less complex alloys to those with a greater number of components. Author (GRA)

N71-36874# Army Foreign Science and Technology Center, Charlottesville, Va.
STRUCTURE OF ALUMINUM AND AN ALUMINUM

ALLOY WITH 3 PERCENT COPPER WITH THERMOMECHANICAL PROCESSING [STRUCTURA ALYUMINIYA I SPLAVA ALYUMINIYA S 3 PERCENT MEDI PRI TERMOMEKHANICHESKOI OBRABOTKE]

M. I. Zakharova 24 Jun. 1971 12 p Transl. into ENGLISH of the Russian book

(AD-726731; FSTC-HT-23-425-70) Avail: NTIS CSCL 13/8

A study was made of the structural state of mono and polycrystals of Al and an alloy of Al with 3% Cu after deformation from 10 to 100% at various temperatures. Among the findings from a thorough series of tests, it was noted that with heating of an alloy for 27 hours at a temperature only 40 C below the melting point, no recrystallization occurs; this gives basis for assuming that in the process of deformation of an alloy of Al with 3% Cu at 560 C a polygonized state is formed which has a high stability at high temperatures. The structure of macrocrystalline samples of aluminum after deformation at 150 and 630 C and an alloy of Al with 3% Cu at 560 C is similar to the structure of monocrystals deformed under these same conditions. Author (GRA)

N71-36875# Army Foreign Science and Technology Center, Charlottesville, Va.

THE PROPERTIES OF THE HIGHLY HEAT-RESISTANT EP457 ALLOY [SVOISTVA VYSOKOZHARO PROCHNOGO SPLAVA EP457]

V. K. Tsvetkova 4 Nov. 1970 13 p Transl. into ENGLISH of the Russian book

(AD-726732; FSTC-HT-23-430-70) Avail: NTIS CSCL 11/6

The heat resistant properties of the EP457 (KhN60MBT10) alloy are investigated. The mechanical properties of specimens of this alloy are shown graphically and it is shown that an increase in the molybedenum content in the alloy by specified amounts raises the resistance to plastic deformation and restricts the region of high plasticity to a relatively narrow temperature range. The heat treatment conditions are outlined which result in the most favorable levels for alloy mechanical properties. A tendency toward the formation of extra-axial liquefaction non-uniformities is reduced by the employment of electroslag remelting. GRA

N71-36876# Army Foreign Science and Technology Center, Charlottesville, Va.

EFFECT OF TEMPERATURE ON THE STABILITY OF A HARDENED STATE OF HEAT-RESISTANT ALLOYS SUBJECTED TO MECHANICAL-THERMAL PROCESSING AND MULTIPLE MECHANICAL-THERMAL PROCESSING [VLIYANIE TEMPERATURY NA USTOICHIVOST' SOSTOYANIYA ZHAROPROCHNYKH SPLAVOV PODVERGNUTYKH MTO I MMTO]

L. K. Gordienko et al 24 Jun. 1971 17 p refs Transl. into ENGLISH from the mono. "Structure and Properties of Heat Resistant Metallic Materials" Moscow, 1967

(AD-726839; FSTC-HT-23-426-70) Avail: NTIS CSCL 11/6

A study was made of the behavior of materials hardened by the mechanico-thermal processing method at various service temperatures. The experiments were made on samples cut from tubes from steam super heaters of boilers. Tests for long-term endurance were made on two consignments of samples: (a) in a state after a standard regime of thermal processing; (b) in a state after multiple mechanico-thermal processing of prenormalized samples by successive deformation of the samples by 1.2, 1.0 and 0.8% with intermediate and final aging at 150 C for 6 hours. It was concluded from these tests that it is desirable that industry adopt the multiple mechanic-thermal processing method for increasing the heat-resistant properties and reliability of operation of boiler steels of the pearlite class. It was also found that the optimum regime of mechanico-thermal processing is an effective means for increasing the heat resistance of the alloy EI817 at a temperature of 700 C and stresses below 45 kg/sq mm. Other tests revealed that mechanico-thermal processing and multiple mechanico-thermal processing of heat-resistant alloys and heat-resistant steels lead to a substantial change in the two principal heat-resistant criteria: capacity of the metal for resisting deformation under creep conditions and its capacity for resisting destruction. GRA

N71-36877# Oregon State Univ., Corvallis. Dept. of Chemistry.

FILIFORM CORROSION OF ALUMINUM Final Summary Report

W. H. Slabaugh, W. Dejager, S. E. Hoover, and L. L. Hutchinson 1 Jul. 1971 31 p refs

(Contract N00019-69-C-0294)

(AD-726739) Avail: NTIS CSCL 11/6

Generally, filiform corrosion occurs on aluminum when it is coated with an organic coating and the system is exposed to relatively high humidities. This type of corrosion is initiated or activated by the presence of electrolytes, particularly chloride, and it is fostered by exposures to warm, humid environments. This type of corrosion is most intense where the coating is mechanically ruptured and discontinuous. Hence, in actual practice those places where mechanical fastenings are involved, filiform develops and produces deleterious results. The problems of the mechanism of this kind of corrosion and the means of controlling or inhibiting this action have not been fully resolved, and the paper is directed toward these two aspects of the filiform corrosion of aluminum. Author (GRA)

N71-36878# Army Foreign Science and Technology Center, Charlottesville, Va.

SHORT-TERM AND LASTING STABILITY OF BETA-ALLOY SYSTEMS Ti-Mo-Cr-Fe-Al AT HIGH TEMPERATURES [KRATKOVREMENNAYA I DLITELNAYA PROCHNOST BETA-SPLAVA SISTEMY Ti-MO-CR-FE-AL PRI VYSOKIKH TEMPERATORAKH]

H. V. Agaev et al 24 Jun. 1971 15 p refs Transl. into ENGLISH of the publ. "Struct. and Properties of Metal and Refractory Mater." 1967

(AD-726729; FSTC-HT-23-421-70) Avail: NTIS CSCL 11/6

The effects of various methods of heat processing of alloys as to heat resistance and mechanical properties were investigated. Tests showed that an alloy seasoned at 550 C for 15 hours had the least deformation at high temperatures. These alloys had the best mechanical properties and can be used as heat-resistant material up to 450 C. They retain stability in limits 130-127 kg (force)/sq mm, pliability 6-8%. It is possible to obtain highly heat-resistant properties in an alloy by selecting the proper thermal process to produce a polygon structure of the Beta-grain which in turn creates a uniform distribution of alpha-phase. Author (GRA)

N71-36879# Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.

DEVELOPMENT OF 18% NICKEL MARAGING STEEL ROCKET MOTOR CASES

Daikichiro Mori, Yoshio Ando, Kazuhisa Suzuki, and Akira Nakano Jun. 1971 29 p refs *Its* Vol. 36, No. 7

(ISAS-466) Avail: NTIS

The development of 18% Ni maraging steel for rocket motor cases from 1965 to 1971 is discussed. The fundamental research on strength, ductility, and notch toughness of both the base material and welds is described. Results of hydrostatic tests of the model vessels to establish the structural integrity and to verify adequacy of the material selection, fabrication techniques, and heat-treatment methods are described, and finally the application to Mu and Lambda rocket motor cases are briefly reported. Author

N71-36880# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

MECHANICAL PROPERTIES OF REFRACTORY METALS

A. P. Gulyaev et al 19 Mar. 1971 19 p refs Transl. into ENGLISH from the book "Fiz.-khim. issled. Zharoprochnykh Splavov" Moscow, Izd.-vo Nauka, 1968 p 32-39

(AD-726609; FTD-HT-23-137-71) Avail: NTIS CSCL 11/6

The article considers the effect of temperature, as well as

the principal metallurgical and technological factors (impurity content, structural state and deformation rate) on the mechanical properties of refractory metals of groups VA and VIA. The temperature dependences of the mechanical properties and the influence of these factors are of a diverse character in the range of low, medium, and high homologous temperatures. Some regularities are noted in changes in the plastic-to-brittle transition temperature for refractory metals in relation to the above-enumerated factors. It is shown that metals of industrial purity in tensile tests in a given range are characterized by a tendency towards intergranular fracture (hot brittleness). The plasticity level in the hot-brittleness temperature range and the limits of this range depend on the impurity content and the deformation rate. Author (GRA)

N71-36881# Battelle Memorial Inst., Columbus, Ohio. Defense Metals Information Center.
DESCRIPTION AND ENGINEERING CHARACTERISTICS OF ELEVEN NEW HIGH TEMPERATURE ALLOYS
Ward F. Simmons Jun. 1971 43 p refs
(Contract F33615-71-C-1067)
(AD-726818; DMIC-Memo-255) Avail: NTIS CSCL 11/6

The Memorandum contains a description and summary of preliminary properties of eleven new alloys that are considered to be promising high-temperature materials. Most of them are in the experimental-application stage of their development; however, a few have reached the point where they can be considered commercial. Included are six nickel-base alloys, two iron-base alloys, one iron-nickel-base alloy, one cobalt base alloy, and one multicomponent alloy that contains primarily nickel and chromium. Following descriptions of composition and microstructure of each alloy, a large section of the memorandum is concerned with physical and mechanical properties, predominantly stress-rupture and creep properties. Oxidation and sulfidation as well as elevated temperature stability of the alloys is discussed. Information on processing and availability of the alloys is also given. Author (GRA)

N71-36882*# Du Pont de Nemours (E. I.) and Co., Aiken, S.C.
THE HOT-SALT STRESS CORROSION CRACKING OF TITANIUM ALLOYS
R. S. Ondrejcin Washington NASA Oct. 1971 25 p refs
(NASA Order R-41-003-001; Contract AT(07-2)-1)
(NASA-CR-1829) Avail: NTIS CSCL 11D

Research on the mechanism for initiation and propagation of hot-salt cracks in titanium alloys is summarized. When a titanium alloy coated with an apparently dry halide salt is heated between 250-650 C, the hydrogen halide penetrates the protective oxide film and attacks the metal. Hydrogen is generated by the reaction of the hydrogen halide and metal and is partially absorbed by the metal surface. The hydrogen embrittles the surface, and the crack can then be initiated by residual or applied stresses. Cracks propagate by stress sorption, with hydrogen as the sorbing species. Author

N71-36883# Bureau of Mines, College Park, Md. Metallurgy Research Center.
RECOVERY OF CADMIUM AND NICKEL FROM SCRAP BATTERIES
D. A. Wilson and B. J. Wiegard, Jr. Washington 1971 18 p refs
(BM-RI-7566) Avail: NTIS

A cyclic leaching process was developed for selectively leaching and recovering cadmium from nickel-cadmium scrap battery waste. The six major steps in the process are the following: (1) washing the plates to remove KOH electrolyte, (2) roasting at 550 to 600 C to oxidize metallic cadmium and decompose cadmium and nickel salts, (3) leaching with an ammonium nitrate solution, (4) precipitation of the leached cadmium from solution as cadmium carbonate using CO2 gas, (5) removal of CO2 from the lixiviator by adjusting to pH 4.5, heating, and evacuating the system, and (6) removal of small amounts of leached nickel from the lixiviator using a solvent extraction technique. The regenerated lixiviator is then recycled to leach additional plates. Cadmium extraction was 94 percent and the cadmium carbonate product contained 0.14 percent nickel and 0.12 percent cobalt impurity. The leached plates were smelted to a high nickel-low iron alloy with no detectable amounts of cadmium. Author

N71-36884# National Materials Advisory Board, Washington, D.C. Panel on Depleted Uranium.
TRENDS IN THE USE OF DEPLETED URANIUM
Jun. 1971 183 p refs
(Contract GS-00-(P)-94008)
(NMAB-275) Avail: NTIS

Information on uranium and its compounds to assist in assessing the impact of changing technology on their future requirements is presented. The data may stimulate greater interest in the usage of depleted uranium in nonnuclear applications, thus bringing its consumption in closer balance with its supply level. Topical areas include depleted uranium's supply situation, present nonenergy consumption, potential uses, metallurgy, chemistry, and effectiveness as a catalyst and alloying element. Current consumption for nuclear uses is small. The only major area of promise involving large quantities of depleted uranium is in breeder-power reactors where a development program is being supported by Government and industry. However, significant quantities are not expected to be used in breeder reactors until after 1985. Author

N71-36885*# Battelle Memorial Inst., Columbus, Ohio. Radiation Effects Information Center.
RADIATION EFFECTS DESIGN HANDBOOK. SECTION 7: STRUCTURAL ALLOYS
M. Kangilaski Washington NASA Oct. 1971 151 p refs
(Contract NASw-1568)
(NASA-CR-1873) Avail: NTIS CSCL 11F

Summary information is presented on the effects of radiation on structural alloys. The radiation form is neutrons with a small amount of gamma information. Information is included on aluminum, beryllium, magnesium, titanium, zirconium, various steels and refractory metals. Some cryogenic work is discussed. Author

N71-36886*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
EXPLORATORY INVESTIGATION OF YTTRIUM, LANTHANUM, AND HAFNIUM COATINGS FOR NITRIDATION PROTECTION OF CHROMIUM ALLOYS
Joseph R. Stephens Washington Oct. 1971 32 p refs
(NASA-TN-D-6528; E-6189) Avail: NTIS CSCL 11F

Chromium alloys were coated with yttrium, lanthanum, and hafnium, either singly or in combination, by pack cementation. Based on ductile-brittle transition temperature, a complex Cr + Y + La coating offered the most potential for protecting chromium alloys from nitrogen embrittlement. For example, the transition temperature for a chromium - 0.17-wt %-yttrium substrate coated with this complex Cr + Y + La coating was 450 K (350 F) after isothermal exposure in air at 1420 K (2100 F) for 200 hours, compared to a transition temperature of 840 K (1050 F) for the similarly exposed uncoated substrate. Simple yttrium coatings are more attractive as coatings for chromium alloys than simple lanthanum and hafnium coatings. Author

N71-36887# Joint Publications Research Service, Washington, D.C.
METALLURGICAL SCIENCE IN NEW FIVE-YEAR PLAN
I. N. Golikov 21 Sep. 1971 9 p Transl. into ENGLISH from Stal (Moscow), no. 7, 1971 p 577-581
(JPRS-54099) Avail: NTIS

A fundamental improvement in the quality of metallurgical output as a result of the introduction of advanced methods of metal production and the expansion of the assortment of rolled metal products, pipes, and metalware with a view to greatly

increasing the efficiency of metal use in the national economy is discussed. The development of many processes is based on fundamental studies in the field of physical chemistry, thermodynamics, the theory of plastic deformation of metals, and the atomic nature of the processes occurring in solid metals.
Author

N71-36888# Royal Aircraft Establishment, Farnborough (England).
INVESTIGATION IN THE FIELD OF THE CHEMISTRY OF MOLYBDENUM. REPORT 1: THE DELAYED OXIDATION OF MOLYBDENUM DISULPHIDE DURING REACTION WITH CARBON DIOXIDE [ISSLEDOVANIE V OBLASTI KHIMII MOLIBDENA, SOOBSHCENIE 1: IZUCHENIE PROTSESSA ZAMEDLENNOGO OKISLENIYA DISULFIDA MOLIBDENA V REAKTSIYAKH VZAIMODEISTVIYA EGO S UGLEKISLYM GAZOM]
M. A. Samedov et al Jan. 1971 33 p refs Transl. into ENGLISH from Tr. Inst. Khim., Akad. Nauk Azerb. (USSR), v. 13, 1964 p 5-19
(RAE-Lib-Trans-1494) Avail: NTIS

The reactions occurring between CO2 and MoS2 were studied in the temperature range 100-1100 C. Reaction commences at approximately 200 C, but only to a very limited extent. Below 500 C,the quantities of gaseous products are insufficient for quantitative analysis. The rate of reaction increases with increasing temperature; complete reaction occurs in 54 h at 900 C. The main solid reaction product is MoO2, whilst CO and SO2 are the major gaseous products. Liquid reaction products were not observed. The main reaction is expressed by the equation MoS2 + 6CO2 = MoO2 + 2SO2 + 6CO. The expected ratio of 1:3 between the gaseous products SO2 and CO is not observed, and this is attributed to side reactions.
Author

N71-36889# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
POSSIBILITY OF PRODUCING SUBSTRUCTURES WITH GIVEN CHARACTERISTICS
S. M. Braun et al 8 Mar. 1971 10 p refs Transl. into ENGLISH from Fiz. Priroda Plast. Formatsii Razrusheniya Metallov (USSR), no. 21, 1969 p 81-87
(AD-727420; FTD-HC-23-664-70) Avail: NTIS CSCL 11/6

The close relation between mechanical properties of metals and their structure is well known. Structure is determined in different ways be the kind, no., and distribution of defects in the crystal lattice. The large effect of the size of substructure entities and their disorientation on mechanical properties has been recognized, but it has been difficult to decide which element of structure plays the decisive role, and to prep. materials with the desired structures. Some new regularities have been found in the formation of substructures, which would allow certain substructures to be prepared with given characteristics. An X-ray technique was used to determine some structural changes in the grains of polycryst. Ni under various treatments. Besides other characteristics, the angles of disorientation of the substructure entities as a function of deformation temperature were studied. The specimens were strained in tension to 2-4 percent.
Author

N71-36890# Army Foreign Science and Technology Center, Charlottesville, Va.
SOME CHARACTERISTICS OF THE BEHAVIOR OF HEAT RESISTANT ALLOYS UNDER CYCLICALLY CHANGING TEMPERATURES [NEKOTORYE OSOBENNOSTI POVEDENIYA ZHAROPOCHNYKH SPLAVOV PRI TSIKLICHESKI MENYAYUSHCHIKHSYA TEMPERATUPAKH]
V. I. Prosvirin et al 4 Nov. 1970 12 p Transl. into ENGLISH from the Russian report
(AD-727357; FSTC-HT-23-431-70) Avail: NTIS CSCL 11/6

Billets (15 mm in diameter and 180 mm in length) in a thermally processed state were subjected to heatings under cyclically changing temperatures (700-850 C) in 3 regimes. It was found that with cyclically changing temperatures, when processes of softening and hardening alternate in the alloy EI437B, long-term endurance (strength) can be reduced by several times. The degree of this decrease is dependent on cycle duration. An alloy with molybdenum is also softened in several cycles. There is a gradual decrease in long-term strength with an increase in the number of cycles. An increase in holding at the upper temperature of the cycle intensifies softening. An increase of softening at the lower cycle temperature first intensifies softening the alloy, but this then increases. A decrease in the heat resistance of an alloy is caused by: (a) an improverishment of the basic solid solution with titanium and aluminum, being extended on the formation of additional quantities of the gamma-phase; and (b) a fragmentation of the basic grains and the formation of secondary segregations on their boundaries which weaken intergranular cohesion.
Author (GRA)

N71-36891 National Lending Library for Science and Technology, Boston Spa (England).
THE ENERGETIC SIGNIFICANCE OF THE CARBON ANODE FOR THE FUSION-ELECTROLYTIC REDUCTION OF METAL OXIDES
S. Wilkening et al 12 Mar. 1971 12 p refs Transl. into ENGLISH from Metall (West Germany), v. 3, no. 24, Mar. 1970 p 236-243
(NLL-M-20409-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The application of the combustion energy of carbon for high temperature fuel cells is discussed. In order to eliminate mechanical difficulties caused by the use of carbon, indirect combustion processes are employed. The use of carbon anodes in the fusion-electrolyic extraction of metals from metal oxides is described. Thermodynamic aspects of anodic carbon oxidation are explained. Numerical analysis and chemical reactions involved in carbon oxidation are presented.
Author

N71-36892 National Lending Library for Science and Technology, Boston Spa (England).
IMPURITIES IN LIQUID LITHIUM
1 Jun. 1971 11 p refs Trans. into ENGLISH from the publ. "Physicochemical Fundamentals of the Use of Liquid Metal Coolants" Moscow, Goostomizdat., 1970
(NLL-Risley-Trans-2169-(9081.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Isoberic-isothermal potentials are discussed for lithium oxide reduction by metals. The oxygen distribution between lithium and sodium was calculated using phase diagrams and estimates of sodium oxide solubility in lithium. Similar calculations were made for other metallic impurities. Concentrations of impurity oxides, nitrides, carbides, and hydrides in liquid lithium are given as well as equilibrium concentrations at 300 C.
J.M.

N71-36893 National Lending Library for Science and Technology, Boston Spa (England).
INVESTIGATION OF THE DECOMPOSITION OF A SOLID SOLUTION OF TANTALUM IN NICKEL
M. I. Zakharova et al 12 May 1971 6 p refs Transl. into ENGLISH from Russian report
(NLL-M-21009-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

An investigation was conducted into the decomposition of a supersaturated solid solution in the alloy Ni-8 at% Ta, by X-ray analysis of single crystals, transmission electron microscopy of thin foils, and optical microscopy of single and polycrystals. The investigation was carried out after isothermal tempering at 650 and 800 C. The experimental data showed that at these temperatures decomposition of the solid solution takes place in this alloy without a zoned stage by the direct precipitation of three-dimensional crystallites of the equilibrium phase Ni3Ta. In the precipitation of this phase, decomposition of the solid solution takes place according to a two-phase mode. It was found that the size of the crystallites changes from 300 x 300 A to 1 x 7.5 microns when increasing the tempering time at 650 C from 25 to 200 hours, and from 200 A to 2 microns when

increasing the tempering time at 800 C from 20 min to 48 hours. Author

N71-36894 National Lending Library for Science and Technology, Boston Spa (England).
THE EFFECT OF HARDENING TEMPERATURE ON THE PROPERTIES OF HIGH-SPEED STEELS
L. V. Sorokina 12 May 1971 6 p refs Transl. into English from Stal (USSR), no. 1, 1971 p 67-68
(NLL-M-21013-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The relationship between the mechanical properties of tool steels and the hardening temperature was studied in specimens with various compositions of carbon, tungsten, vanadium and cobalt. It was found that the hardness of all the steels increases with hardening temperature. F.O.S.

N71-36895 National Lending Library for Science and Technology, Boston Spa (England).
INVESTIGATIONS OF THE EFFECT OF LITHIUM AND CHROMIUM ON THE STRESS CORROSION RESISTANCE OF AlZnMg ALLOYS
H. J. Engell et al 13 Apr. 1971 12 p refs Transl. into ENGLISH from Z. Metallk. (Stuttgart), v. 61, no. 4, Apr. 1970 p 261-266
(NLL-M-20438-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The effect of lithium and chromium additives on the stress corrosion resistance of aluminum-zinc-magnesium alloys is discussed. Subjects presented are: (1) effect of lithium concentration, (2) drop in tensile strength caused by corrosion without stress, (3) effect of storage sensitivity to stress corrosion, (4) kinetics of age hardening, and (5) effect of corrosive media. Author

N71-36896 National Lending Library for Science and Technology, Boston Spa (England).
CRITERIA FOR THE OPERATIONAL RELIABILITY OF 12 Cr 1 MoV STEEL
V. F. Ziepko 10 Mar. 1971 7 p refs Transl. into ENGLISH from Elek. Sta. (USSR), v. 41, no. 4, Apr. 1970 p 32-34
(NLL-CE-Trans-5569-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Samples of 12Cr-1MoV steel, extensively used in the manufacture of steam pipes, were examined from five melts of steel which had operated with steam conditions of 140 kg/sq cm, 565 C. The tests included a study of structural changes, and changes in the mechanical and high temperature strength of the steel. The criterion suggested for assessing the operational reliability is the steel structural change factor. Author

N71-36897 National Lending Library for Science and Technology, Boston Spa (England).
HEAT TREATMENT AND PROPERTIES OF MARAGING 12Ni-16Co-11Mo STEEL
M. N. Bodyako et al 20 Mar. 1971 13 p refs Transl. into ENGLISH from Izv. Akad. Nauk Belorus. SSR (USSR), no. 1, 1970 p 47-53 In RUSSIAN and ENGLISH
(NLL-Trans-746-807-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Systems of heat treatment and properties of steels containing 8 to 16 percent nickel, 15 to 15.4 percent cobalt, and 10 to 10.5 percent molybdenum are discussed. It is shown that after aging at 480 to 530 C for 3 hours, high mechanical properties can be obtained in steels containing 12 to 15 percent nickel. Increased brittle destruction susceptibility with a decrease in the nickel content is described. With a nickel content of 14 to 15 percent, the drop in stability and increase in ductility is examined. Author

N71-36898 National Lending Library for Science and Technology, Boston Spa (England).
A METHOD OF OBTAINING MICROAUTORADIOGRAMS FROM THE SURFACE OF IRRADIATED ALUMINIUM
Yu. P. Pshenichnov et al 12 Mar. 1971 11 p refs Transl. into ENGLISH from Russian report In RUSSIAN and ENGLISH
(NLL-Windscale-448-(9091.9F)) Avail: Natl. Lending Library Boston Spa Engl.; 1 NLL photocopy coupon

Procedures are outlined for obtaining microautoradiograms of the distribution of impurities in 99.99% pure aluminum. The irradiation times, decay curves, and durations of exposure were examined and a gamma spectrometric analysis was performed to identify the isotopes after different decay times. J.G.M.

N71-36899 National Lending Library for Science and Technology, Boston Spa (England).
THE DETERMINATION OF THE ACTIVITY OF ALUMINUM AND COPPER IN MOLTEN Al-Cu BINARY ALLOYS BY THE BUBBLING METHOD [KIHO FUNRYUHO NI YORU YOYU AL-CU GOKIN CHU NO AL OYOBY CU KATSURYO NO SOKUTEI]
H. Miteni et al Jun. 1971 10 p refs Transl. into ENGLISH from Nippon Kinzoku Gakkaishi (Japan), v. 33, no. 3, 1969 p 344-348
(NLL-RTS-6273) Avail: Natl. Lending Library, Boston Spa, Engl.: £0.90; 3 NLL photocopy coupons

The reactivity of a molten Al-Cu alloy with AlCl3 was studied in the compositional range of an atomic fraction of N(Cu) = 0 to 0.574 by blowing fine bubbles of AlCl3 gas into the molten alloy and utilizing the equilibrium constant previously ascertained. The Al and Cu activities of the molten alloy at 1200 and 1100 C were measured. The Al activity showed a considerable negative deviation from Raoult's law in the compositional range N(Al) < 0.7 and N(Cu) < 0.8, which showed a tendency to conform well with electromotive force measurement results at 1100 C. The AlCl3 reaction rate and gas flow rate were shown to cancel one another. The Al transport velocity was increased by increasing the product of the AlCl3 reaction and the gas flow rate. When the flow rate was increased the reaction rate decreased and the Al transport velocity increased. The trend showed a marked decrease as the Cu component increased and the reaction temperature decreased. Author

N71-36900 National Lending Library for Science and Technology, Boston Spa (England).
PRELIMINARY EVALUATION OF AN Ni-Ta OBTAINED BY UNIDIRECTIONAL SOLIDIFICATION [VALUTAZION PRELIMINARE DI UN MATERIALE COMPOSITO NI-TA OTTENUTO PER SOLIDIFICAZIONE UNIDIREZIONALE]
G. Beghi et al 17 Mar. 1971 35 p refs Transl. into ENGLISH from Italian report EUR/C-IS/330/70 In ENGLISH and Italian
(NLL-LTI-746-703) Avail: Natl. Lending Library, Boston Spa, Engl.: 4 NLL photocopy coupons

The unidirectional solidification technique has been successfully used for the reinforcement of a metallic or ceramic material, in the required direction. The technique consists in subjecting the material to transformation from a hot area (material in the liquid state) to a cold area (material in the solid state), while keeping the solidification face flat and perpendicular with the direction of solidification. In the case of eutectic alloys a fibrous or lamellar oriented structure is obtained, under certain conditions. The Ni-Ta eutectic (37 wt.% Ta) is discussed. The propensity of this system to exhibit an oriented fibrous structure when subjected to unidirectional solidification, and the mechanical properties and stability at temperatures of the order of 800 C are described. 10 mm diameter bars were produced from the alloy, and subjected to unidirectional solidification, in a specially constructed apparatus. Metallographic examination showed that, under certain conditions, the Ni-Ta system solidifies with a lamellar structure made up of a continuous matrix (an Ni-Ta solid solution) and a second, discontinuous, lamellar phase (TaNi3 intermetallic). The mechanical properties were investigated through tensile and hot hardness tests, at ambient temperature and at 800 C. Author

N71-36901 National Lending Library for Science and Technology, Boston Spa (England).
TESTING OF IMPACT STRENGH OF STEEL
A. P. Gulyaev et al Nov. 1970 5 p refs Transl. into ENGLISH from Fiz.-Khim. Mekh. Mater. (USSR), v. 6, no. 1, 1970 p 76-79
(NLL-Trans-746-679-(9022.401); NLL-LTI-737-9103) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Procedures for determining the impact strength of various steel samples are discussed. Factors controlling the impact strength of steel are presented. The test equipment used and results obtained for various alloys of steel are described. Author

N71-36902 National Lending Library for Science and Technology, Boston Spa (England).
STUDY OF EFFECT OF STRESS RELAXATION ON STRUCTURE OF AUSTENITIC STEELS
A. M. Borzdyka et al Nov. 1970 6 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Metally (Moscow), no. 3, 1970 p 152-157 In ENGLISH and RUSSIAN
(NLL-Trans-746-678-(9022.401); NLL-LTI-737-9159) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Stress relaxation tests were conducted with carbide, and carbide-intermetallic hardened austenitic steels. The microstructure and phase composition after the tests were compared with the initial states. It was found that the proces of relaxation does not influence the microstructure and phase composition of the austenite. F.O.S.

N71-36903 National Lending Library for Science and Technology, Boston Spa (England).
STRUCTURE OF MULTI-COMPONENTS NI-P-W PLATING
A. F. Belyakova et al Nov. 1970 4 p refs Transl. into ENGLISH from Metalloved. i Term. Obrabotka Metal. (USSR), no. 5, 1970 p 64-66 In ENGLISH and RUSSIAN
(NLL-Trans-746-675-(9022.401); NLL-LTI-737-9065) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The properties, composition, and structure of electroless nickel deposits, alloyed with tungsten were investigated. The coating is a finely dispersed mixture of grains of the supersaturated solid solution of phosphorus and tungsten in nickel and nickel phosphides. The lines of the solid solution were not discovered due to their diffusion. During tempering the supersaturation of the solid solution decreases; the dimension of the grain increases, accompanied by the appearance of the X-ray grams of diffused lines of nickel. With a further increase of tempering temperature, the solid solution becomes more equilibrium, the grain of the solid solution increases, and the dispersion of the phosphides decreases. This is confirmed by microstructural analysis and a comparison of the etching capacity and hardness of the samples. The decrease of the microhardness after the maximum is linked with the enlargement of the grains of the phosphides and the solid solution. Author

N71-36904 National Lending Library for Science and Technology, Boston Spa (England).
INVESTIGATION OF MECHANICAL PROPERTIES OF T-Mo-Ni ALLOYS
S. V. Kalabukhova et al Nov. 1970 3 p refs Transl. into ENGLISH from Izv. Akad. Nauk. SSSR, Metally (Moscow), no. 3, 1970 p 184-186 In ENGLISH and RUSSIAN
(NLL-Trans-746-691-(9022.401); NLL-LTI-737-9162) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Concentration dependencies of tensile strength, yield point, and relative elongation of Ti-Mo-Ni alloys are investigated. It is concluded that the introduction of 0.2 wt.% nickel into titanium increases the tensile strength of the alloys from the area of the alpha-solid solution almost twice. The Ti-Ni alloy with a content of 8 wt.% Ni and a eutectoid structure possesses the highest tensile strength, equal to 100 kg/sq mm. Of all the Ti-Mo-Ni alloys, the alloys with a ratio Mo: Ni = 1:1 and with a content of Mo, Ni from 0.4 to 1.8 wt% possess the best calculated stable and plastic properties. Alloys with a ration of Mo:Ni = 3:1 and 1:1 and with a content of 10 wt.% Mo, Ni are brittle. They possess the highest tensile strength, equal to 148-150 kg/sq mm, and yield point equal to 144-145 kg/sq mm. E.M.C.

N71-36905 National Lending Library for Science and Technology, Boston Spa (England).
THE SELECTIVITY OF CHELATING AGENTS FOR THE SPECTROPHOTOMETRIC DETERMINATION OF Fe(III) AND SOME PROPERTIES OF THE COMPLEXES
M. Hayakawa et al 1967 7 p refs Transl. into ENGLISH from Kyoritsu Yakka Daigaku Kenkyu Nempo (Tokyo), v. 12, 1967 p 62-65
(NLL-CE-Trans-5650-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The results of experimental work on chelate complexes of iron which might be employed in the microdetermination of Fe(III) are presented. Complexes were prepared from a number of chelating agents and examined spectrophotometrically. While, under suitable conditions, iron complexes were found to be produced by the respective chelating agents, a comparative study of their properties was undertaken to determine which reagent was the most selective for Fe(III) and most suitable for the microdetermination of iron. Author

N71-36906 National Lending Library for Science and Technology, Boston Spa (England).
DETERMINATION OF THE AGEING BEHAVIOR OF ALUMINUM COMPRESSION JOINTS, AND ITS CAUSES
D. Sander [1970] 15 p refs Transl. into ENGLISH from Elektrizitatswirtschaft (Frankfurt am Main), v. 69, no. 19, 14 Sep. 1970 p 526-530
(NLL-OA-Trans-637-(6196.3)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The causes of contact corrosion in aluminum compression joints and methods for preventing corrosion are discussed. The characteristics of the methods which have been developed for assessing the quality of contacts are described. An outline is provided of the problems encountered in standardization of conductors and connectors. Author

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N71-36907*# United Aircraft Corp., East Hartford, Conn.
DETERMINING AND ANALYZING THE STRENGTH AND IMPACT OF HIGH MODULUS GLASS Quarterly Status Report
J. F. Bacon 15 Aug. 1971 15 p refs
(Contract NASw-2209)
(NASA-CR-122775; QSR-2; K911105-2) Avail: NTIS CSCL 11B

Tests of epoxy resin composites in comparison to similar composites made with experimental organic fibers show that the epoxy resin composites have a compressive strength 4 1/2 times higher as well as specific compressive strength at least 2 1/2 times greater. Flexural strength, bending stress-strain behavior, short-beam shear strength, tensile strength, tensile stress-strain behavior, and impact strength were compared. Author

N71-36906*# Gillette Research Inst., Inc., Rockville, Md.
MEASUREMENT OF CONTACT ANGLES AND EVALUATION OF SURFACE COATINGS
Geoffrey Frohnsdorff and Silvestre Tejada Aug. 1971 62 p refs
(Contract NAS3-13725)
(NASA-CR-72975) Avail: NTIS CSCL 11C

Surface treatments were sought which would give high and stable contact angles (theta) with water, methanol and Freon 11 at 20 C and at the normal boiling point of each liquid in the presence of only the liquid vapor. A special chamber was constructed for the measurements of theta. Coatings studied were the commercial products TE-3170, FEP Teflon, Vydax 201G, Zepel B, TLF-2475 and TLF-1914. They were, respectively, a PTFE, a TFE-HFP copolymer, a TFE telomer, two polyacrylic acid esters of perfluorinated alcohols, and a perfluorinated compound with a phosphate group. Perfluorooctanoic acid monolayers were also used. With water and methanol, best results were obtained with the first three coatings. Author

N71-36909*# Aerotherm Corp., Mountain View, Calif.
ABLATIVE RESPONSE OF A SILICA PHENOLIC TO SIMULATED LIQUID PROPELLANT ROCKET ENGINE OPERATING CONDITIONS Final Report
Mitchell R. Wool, Carl. B. Moyer, Charles A. Powars, and Roald A. Rindal Jun. 1971 265 p refs
(Contract NAS3-10291)
(NASA-CR-72701; Aerotherm-71-36) Avail: NTIS CSCL 11D

The effect of off-optimum rocket engine operating conditions on ablative material performance was investigated theoretically and experimentally. Experiments were conducted utilizing an arc plasma generator as the energy source to simulate the products of combustion of N2O4 - N2H4/UDMH for mixture ratio varying from pure oxidizer to nearly pure fuel and for simulated characteristic velocity ratio from 0.85 to 1.10. Calorimetric measurements reveal a 70 percent heat transfer coefficient increase associated with surface roughness similar to the ablating surface. Silica phenolic nozzle test results reveal the strong dependence of ablation magnitude and character upon mixture ratio. For constant stream temperature minimum surface recession occurs for oxidizer-to-fuel mass ratio of 1.0 and departures from this (lean or rich) result in significant surface recession increases. Surface recession decreases with temperature for all mixture ratio. Ablation predictions sucessfully predict the trend and magnitude of ablation for high mixture ratio and high simulated characteristics velocity ratio but fail to correctly predict the observed decrease in surface recession with decrease in characteristic velocity. Author

N71-36910*# Union Carbide Corp., Parma, Ohio. Carbon Products Div.
DEVELOPMENT OF SEAL RING CARBON-GRAPHITE MATERIALS (TASKS 3 AND 4)
N. J. Fechter and P. S. Petrunich 31 Aug. 1971 121 p refs
(Contract NAS3-13211)
(NASA-CR-72986) Avail: NTIS CSCL 11D

Carbon-graphite seal ring bodies for operation at air temperatures to 1300 F were manufactured from four formulations and from resin impregnated versions of three of the four formulations. Thermal, chemical, and wear properties of four selected materials were characterized. The results have shown: (1) The porosities, oxidation resistances, and thermal conductivities of the four materials are significantly greater than those of a typical commercial grade. The mechanical and wear properties, although inferior to those of the commercial grade, were judged acceptable for self-acting seal applications. (2) The mechanical properties of carbon-graphite seal ring materials are improved through impregnation with a phenolic resin prior to heat treatment at 2800 C. (3) Materials bonded with the phenolic resin can be more difficult to process than those bonded with the coal tar pitch. (4) Substitution of graphite fibers for carbon black as the minor filler component improves the processibility and strength-to-weight ratio of a material. (5) Addition of small quantities of particulate glassy carbon to one of the materials degraded oxidation resistance without improving wear resistance. Author

N71-36911*# Techtran Corp., Glen Burnie, Md.
TECHNIQUES FOR MEASURING ELECTRIC RESISTIVITY OF CERAMICS AT HIGH TEMPERATURE (1,000-1,700 C) [TECHNIQUES DE MESURE DE LA RESISTIVITE ELECTRIQUE DE CERAMIQUES A HAUTE TEMPERATURE (1.000-1.700 C)]
A. M. Anthony Washington NASA Sep. 1971 12 p refs Transl. into ENGLISH from Bull. Soc. Franc. Ceram. (Paris), no. 74, 1967 p 3-9
(Contract NASw-2037)
(NASA-TT-F-13948) Avail: NTIS CSCL 11B

The four points and two points methods for measuring electric resistivity of ceramics at high temperatures are discussed. The four points method was determined as the better of the two, although the two points method can also be used when attention is paid to ceramic-electrode contacts. Author

N71-36912*# Translation Consultants, Ltd., Arlington, Va.
NEW DATA ON IRIDIUM-OSMIUM COMPOUNDS EXISTENCE OF NATIVE OSMIUM [NOUVELLES DONNEES SUR LES COMPOSES IRIDIUM-OSMIUM EXISTENCE DE L'OSMIUM NATIF]
C. Levy et al Washington NASA Oct. 1971 12 p refs Transl. into ENGLISH from Bull. Soc. Fr. Miner. Cryst. (France), v. 84, 1961 p 312-317
(Contract NASw-2038)
(NASA-TT-F-13758) Avail: NTIS CSCL 11D

Use of the electron microprobe allowed discovery, in various platiniferous concentrates, of the existence of native osmium. The structrual and optical properties of native osmium and artificial osmium are identical having the same hexagonal structure, same characteristics effects of polarization and the same reflectivity. A study of some osmium and iridium compounds shows that all of these have either the hexagonal structure of osmium or the cubic structure of iridium and, further, that their reflectivity increases with iridium content. Examination of the rather complex nomenclature of these minerals is then carried out and a simplification proposed: iridium and osmiferous iridium for the terms of the cubic series; native osmium, iridiferous osmium and osmiridium for the terms of the hexagonal series. Author

N71-36913*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A COMPILATION OF LOW OUTGASSING POLYMERIC MATERIALS NORMALLY RECOMMENDED FOR GSFC COGNIZANT SPACECRAFT
Aaron Fisher and Benjamin Mermelstein Jul. 1971 87 p refs
(NASA-TM-X-65705; X-764-71-314) Avail: NTIS CSCL 11D

More than five hundred similarly tested polymer materials, successfully screened to meet acceptable outgassing criteria, are presented in both application and alphabetical categories. Some polymers with somewhat higher outgassing are included where they must perform a highly selective function and are the only materials available to meet special requirements. Author

N71-36914# National Bureau of Standards, Washington, D.C.
THE FLAMMABLE FABRICS PROGRAM, 1970
Sep. 1971 87 p refs
(NBS-TN-596) Avail: SOD $0.65

Specific flammability standards were considered for carpets, rugs, children's sleepwear and other apparel, blankets, and mattresses. Research included studies, in-house and by contract, on subjects such as full scale carpet burn experiments and heat transfer from burning fabrics. Studies of the feasibility of reducing flammability included pyrolysis of textile materials and chemical aspects of fire retardancy. Test development was completely related to the standards outputs, and training ranged

from the preparation of bibliographies through congressional and public presentations to full time research associateship participation in the program. Cooperation was carried out with HEW, the public, industry, and voluntary standards groups.
Author

N71-36915# Northwestern Univ., Evanston, Ill.
A NEUTRON DIFFRACTION STUDY OF THE MAGNETIC PROPERTIES OF MnAs AND MnAs(.92)P(.08)
Edward Lindley Hall (Ph.D. Thesis) Jun. 1970 209 p refs
Sponsored in part by NSF and ARPA
Avail: NTIS

A study of the magnetic properties of MnAs using neutron diffraction is described. MnAs is somewhat unusual in that it has a first order magnetic phase transformation from ferromagnetism to paramagnetism. This type of transformation is attributed to a volume-dependent exchange and a high compressibility. This high compressibility leads to interesting magnetic behavior at high pressures. However, the actual magnetic structure at these high pressures can only be determined using neutron diffraction. Pressure effects of the magnetic properties of MnAs have been studied using a time-of-flight spectrometer and a double axis spectrometer. With the time-of-flight instrument the pressure dependence of the lattice constants was determined from 0 to 6 kbar at room temperature.
Author

N71-36916# American Univ., Washington, D.C.
AN EXPERIMENTAL STUDY OF THE CRITICAL OPALESCENCE PHENOMENON IN CARBON DIOXIDE
Bruce Sargent Maccabee (Ph.D. Thesis) 1970 250 p refs
Sponsored by NSF
Avail: NTIS

The construction of a light scattering apparatus capable of determining the power law dependences with sufficient accuracy to test the theories is discussed. The use of the apparatus in determining the properties of carbon dioxide in its critical region is described. All of the appropriate exponents of the thermodynamic parameters of carbon dioxide in the critical region have been determined from data taken with the apparatus.
Author

N71-36917# Bendix Corp., Kansas City, Mo.
THERMAL PROPERTIES OF LACTONE ESTER-BASED RIGID URETHANE FOAMS
Mar. 1971 29 p refs
(Contract AT(29-1)-613)
(BDX-613-406) Avail: NTIS

The thermal characteristics of ten rigid urethane foam formulations were studied using thermogravimetric analysis (TGA), differential thermal analysis (DTA), thermalmechanical analysis (TMA), and long-term heat aging. Compressive strength values were determined over a temperature range of -73 C to +204 C for these foam systems. In addition, nitrogen content analysis was performed on each formulation. All of the test results indicate that the polymeric isocyanate foams have better thermal stability characteristics than do the toluene diisocyanate materials. For the various polyol components used in the foam formulations, an alpha methylglucoside ester foam displayed the best high temperature stability.
Author (NSA)

N71-36918# Bendix Corp., Kansas City, Mo.
BLENDING OF SEVEN LOTS OF MERGINAMIDE L-425 FOR USE IN THE M300 ADHESIVE
Mar. 1971 44 p refs
(Contract AT(29-1)-613)
(BDX-613-405) Avail: NTIS

Seven lots of Merginamide L-425, an amine curing agent, were procured and evaluated to determine whether the seven lots met specifications and could be blended into a single homogeneous lot. Merginamide L-425 is used in the M-300 series adhesive. Chemical analyses showed the seven lots of Merginamide L-425 to be very similar to each other and to Lot 548, one of the two lots used in the initial development work. The seven lots met specification. Seven lots of the Comerginates, which are the precursors to Merginamide L-425, were also analyzed, and some variation in molecular weight distribution from lot to lot was found. This was not considered a problem. The processing properties of each lot of Merginamide L-425 were determined. The spreadability life of the M-300 series adhesive made from each lot and from the blended lot was 30 minutes minimum and 35 minutes maximum. As a result, the addition of acrylonitrile to Merginamide L-425 was not required. The adhesives made from each of the seven lots of Merginamide L-425 were thixotropic as was the adhesive made from the blended material. The tensile strengths of the adhesives made from the seven lots were comparable to the tensile strength of the adhesive made from Lot 548 of the Merginamide L-425.
Author

N71-36919# Bendix Corp., Kansas City, Mo.
ELECTRONICS ENGINEERING QUARTERLY
Mar. 1971 359 p refs
(Contract AT(29-1)-613)
(BDX-613-344) Avail: NTIS

A test program was conducted to determine the effects of heat aging on polyimide insulating film. Several properties of this film were evaluated for high-temperature flat cable applications. Time/temperature tests were conducted on two lots of 0.005-inch-thick, 1-inch-wide film as-received from the manufacturer. Specimens from the two lots were exposed to temperatures of 600, 700, and 790 F for intervals of 10, 90, and 170 minutes. Dielectric strength (kilovolts, rms, 60 cps) was tested with 0.25-inch electrodes in oil at a runup rate of one kilovolt per second. The specimens were stabilized in a 50-percent relative humidity atmosphere to keep the effects of humidity constant. Dielectric strength variations between lots of as-received films and between strips within lots were insignificant. Limits on average dielectric strengths were 19.05 to 19.44 kilovolts. Limits on individual specimen strengths were 17.11 to 21.38 kilovolts. Variations between strips within lots of film subjected to time/temperature tests were insignificant. However, differences between lots were detectable.
Author

N71-36920# Bendix Corp., Kansas City, Mo.
PROPERTIES OF PLASMA-SPRAYED ALUMINUM COATING Final Report
Mar. 1971 21 p refs
(Contract AT(29-1)-613)
(BDX-613-408) Avail: NTIS

The characterization of plasma-sprayed aluminum coatings (for protection against electromagnetic interference) on the outer surfaces of electrical assemblies potted in a glass-microballoon-filled epoxy material is discussed. The plasma-sprayed aluminum coatings were applied at a low metal-powder feed rate and a relatively large torch-to-work distance. Six coats of metal were applied to give a coating thickness of 0.010 inch. Under these conditions overheating of the substrate was avoided. The coated samples of glass microballoon-filled epoxy potting compound withstood thermal cycling (-65 F to +165 F); 90 to 95 percent relative humidity at cyclic temperatures from 77 F to 149 F; and salt spray exposure without blistering, cracking, or buckling. The average results of the tensile bond strength tests are given. Coated samples of glass fabric-reinforced printed circuit stock were used to determine coating density and electrical resistivity. The average test results are compared to typical values for wrought material.
Author

N71-36921# Bendix Corp., Kansas City, Mo.
SYNTACTIC FOAM EVALUATION Final Report
D. D. Smith Mar. 1971 129 p refs
(Contract AT(29-1)-613)
(BDX-613-177) Avail: NTIS

The mechanical, physical, and chemical properties of the Imidite SA syntactic foam system were studied, to develop material and quality control information for a syntactic foam

which would meet design requirements. Using Imidite SA powder (prepared from Imidite 2801 prepolymer, silica microballoons, and ceramic fibers), foam billets were fabricated and tested. Results of the tests are shown. Author

N71-38822# Sandia Corp., Albuquerque, N.Mex.
SANDIA LABORATORIES CARBON COMPOSITES DEVELOPMENT PROGRAM
J. K. Johnstone 18 Mar. 1971 14 p Presented at 18th Refractory Composites Working Group Meeting, Huntsville, Ala. 16-18 Mar. 1971
(CONF-710312-1) Avail: NTIS

The successful test flights of two carbon/carbon composite heat shields and a major development/improvement program in carbon/carbon composites are discussed. The successful heat shields represented two material candidates selected after a comprehensive materials evaluation study of a number of carbon composites. The two materials selected were chemical vapor deposition (CVD/felt and CVD/filament wound (FW). The substrate material is a carbon felt or continuous carbon filaments wound in a helical pattern. The matrix carbon is applied by the chemical vapor deposition technique. The carbon composites are subsequently heat-treated at temperatures near 3000 C. In preparation for the MTV-1 flights, emphasis had been placed on scale-up studies and fabrication development. Emphasis is now directed toward materials development, understanding the mechanics of composites and fabrication development which could lead to substantially improved carbon composite materials. Author (NSA)

N71-38823# Bendix Corp., Kansas City, Mo.
POLYURETHANE FOAM MATERIAL AND PROCESS DEVELOPMENT Quarterly Report
J. R. Fender May 1971 28 p
(Contract AT(29-1)-613)
(BDX-613-300; QR-FY-71-2) Avail: NTIS

A study of the effects of varying the ratio of urea-biuret to allophanate linkages on the physical properties of rigid urethane foam is summarized. Laboratory evaluation of five new commercial polyols is described, and compressive and modulus properties of the only promising system from the five are recorded. The problems and successes associated with casting optically-clear polyester prototype parts are outlined. Author

N71-38824# Bendix Corp., Kansas City, Mo.
CONFORMAL-COATING Quarterly Report
W. F. Moyle Feb. 1971 31 p
(Contract AT(29-1)-613)
(BDX-613-286; QR-FY-71-1) Avail: NTIS

The testing of application techniques and mechanical coating characteristics are reported for fireset process control board coatings which will withstand high voltages in 1.25 mmHg atmospheres. A polyurethane and polysulfide coating system and a silicone system were applied to test boards and subjected to a potential of 10 kV in an atmosphere of 1.0 to 1.5 mmHg pressure. Both systems passed the test. Tests to determine the electrical characteristics were performed on a flat conductive surface covered with coating material to limit the variables of testing. It was concluded that either coating system was adequate if the material was properly applied. J.M.

N71-38825# Bendix Corp., Kansas City, Mo.
LINING OF COMPRESSION SET TEST FIXTURES Interim Report
Mar. 1971 23 p
(Contract AT(29-1)-613)
(BDX-613-410) Avail: NTIS

The effects of a number of polymeric films at elevated temperatures on the compression set of cellular silicone rubbers used to cushion dissimilar weapons-related components were investigated. Several lots of Y-3223 and Y-3260 cellular silicones were compression set tested at 300 F for 22 hours in both lined and unlined test fixtures. The films linings used were Mylar, Teflon, and Kapton. While Kapton and Mylar films increased the compression set of all materials tested, Teflon had a variable effect on compression set ranging from a slight decrease to an increase approaching 100 percent, the values depending upon the lot and type of material. If the results are substantiated at normal weapon storage temperatures, the existing compression set test method may be inadequate to ensure acceptable performance of the end item. Author

N71-38826# Wien Univ. (Austria). Inst. for Analyses.
INVESTIGATIONS ON A QUANTITATIVE MINERALOGICAL CHARACTERIZATION OF METEORITES BY MODAL ANALYSIS
G. Doerfler and H. G. Hiesboeck [1971] 25 p refs Submitted for publication
Avail: NTIS

Methods and structural parameters which can be applied for quantitative characterization of chondritic meteorites are outlined. ESRO

N71-38827# Naval Research Lab., Washington, D.C.
THE COEFFICIENT OF FRICTION OF HIGH POLYMERS AS A FUNCTION OF PRESSURE Final Report
R. C. Bowers 16 Jun. 1971 19 p refs
(AD-726885; NRL-7288) Avail: NTIS CSCL 11/8

Recently data has become available for five high polymers: low-density polyethylene, high-density polyethylene, polypropylene, polyvinylidenefluoride, and polytetrafluoroethylene. The report is concerned with the frictional behavior of these same materials in addition to a copolymer of ethylene and tetrafluoroethylene and a copolymer of tetrafluoroethylene and hexafluoropropylene, both in bulk form and as thin films. The experimental values of the coefficient of friction for each polymer agreed well with the values calculated from the pressure/shear strength data, even when this data was extrapolated to higher or lower pressures. It is concluded that the coefficient of friction as a function of pressure can be determined from shear strength measurements, and conversely shear strength as a function of pressure can be estimated from friction measurements of thin films. In general, for thin polymer films, where pressures are usually high, the coefficient of friction will be determined almost entirely by the slope of the shear strength-vs-pressure curve. For bulk polymer specimens the coefficient of friction will be greatly influenced by the intercept on the shear strength axis of that curve and the hardness of the polymer. This accounts for the large difference in the frictional properties between bulk specimens of high-density and low-density polyethylene. Author (GRA)

N71-38828# Picatinny Arsenal, Dover, N.J.
ELECTRICAL CONDUCTIVITY OF IRRADIATED POLYVINYL CHLORIDE AS A FUNCTION OF TEMPERATURE
Kenneth Volet and Philip Zirkind Jun. 1971 17 p refs
(AD-726927; PA-TM-2015) Avail: NTIS CSCL 11/9

The electrical conductivity of polyvinyl chloride was measured as a function of temperature over the range 30-70C before and after irradiation with 1.3 Mev gammas. Three orders of magnitude increase in conductivity were observed for the irradiated specimens after a dose of 4.8 x 10 to the 7th power Rads. Scission of the polymer chain as the dominant effect of the irradiation is postulated. Author (GRA)

N71-38829# General Electric Co., Philadelphia, Pa. Missile and Space Div.
GRAPHITE MELTING BEHAVIOR Final Technical Report, Jul. 1968 - Jun. 1970
N. S. Diaconis, E. R. Stover, J. Hook, and G. J. Catalano Wright-Patterson AFB, Ohio AFML Jul. 1971 85 p refs
(Contract F33615-68-C-1713)
(AD-727064; AFML-TR-71-118) Avail: NTIS CSCL 11/3

An experimental program was conducted to determine the

melting behavior of graphite. Data was obtained with an electric arc heater, and a resistance heater over a pressure range from the triple point to approximately 320 atmospheres. Temperature measurements were made in the arc heater environment with a scanning spectrometer while a recording optical pyrometer was used for the resistively heated specimens. ATJS and pyrolytic graphite were the test materials and argon and nitrogen were the test gases. Within the accuracy of the data the results did not show any discernible difference with gas environments. Arc heater data showed a slight increase in melting temperature over that exhibited by the resistively heated models. Values for the triple point were determined to be 102 atmospheres pressure with temperatures varying between 4100 K and 4300 K depending upon mode of heating and material. Author (GRA)

N71-36830# Midwest Research Inst., Kansas City, Mo.
THE VISCOSITY OF SYNTHETIC TURBINE ENGINE LUBRICANTS FROM 100 F TO 700 F Technical Report, Jul. 1969 - Jan. 1971
Ronald D. Butler Wright-Patterson AFB, Ohio AFAPL Jun. 1971 79 p refs
(Contract F33615-69-C-1265)
(AD-727060; AFAPL-TR-71-36) Avail: NTIS CSCL 11/8

The report describes a technique for the experimental determination of fluid viscosity over the temperature range 100 deg - 700 deg. The method incorporates standard procedures, and meets accepted specifications for data precision and for temperature control and measurement over the entire temperature range. Reliable data of high precision can be obtained for subsequent analysis and prediction of lubricant performance in operating turbine aircraft engines. Complete viscosity data are presented for 30 synthetic lubricants. The following fluid types were included in this study: MIL-L-7808, MIL-L-23699, MIL-L-27502, poly(phenyl ether), and silicone formulations. Statistical analysis of the data indicates that a logarithmic relationship accurately describes the variation of kinematic viscosity with temperature over the entire temperature range. Appropriate equation can be used to calculate fluid viscosity at any desired temperature up to 500 F (or 700 F for thermally stable lubricants) with an average error less than 2%. Author (GRA)

N71-36831# Army Materials and Mechanics Research Center, Watertown, Mass. Metals Div.
WEAR- AND EROSION-RESISTANT COATINGS FOR TITANIUM ALLOYS IN ARMY AIRCRAFT
Milton Levy and Joseph L. Morrossi Dec. 1970 25 p refs
(AD-726954; AMMRC-TR-70-36) Avail: NTIS CSCL 11/3

Diffusion-bonded electroless nickel plate was investigated as a wear-resistant coating for titanium alloys 6 Al-6 V-2 Sn and 8 Al-1 Mo1 V. Plate adhesion and diffusion zone structure were assessed by metallographic and X-ray diffraction techniques. Effects of the diffusion heat treatments on mechanical properties and wear characteristics of the titanium alloys were determined. The diffusion bonding produced a surface of nickel-rich intermetallics which significantly improved the wear resistance of the titanium alloys without any appreciable degradation of their structural integrity. Author (GRA)

N71-36832# Army Missile Command, Redstone Arsenal, Ala. Ground Equipment and Materials Directorate.
SPECIFIC PERMEABILITY OF EPOXY RESIN SYSTEMS
James L. Parham 14 Jun. 1971 22 p refs
(AD-726930; RL-TR-71-5) Avail: NTIS CSCL 11/9

Several types of coatings and filler materials were evaluated for their effectiveness in reducing moisture permeability of epoxy resins. Only the metallic coatings gave significant reductions. The specific permeability of a number of epoxy resin systems is given at room temperature and 140 F. Data is presented on the effects of post cure, curing agent concentration, and specimen thickness on specific permeability. Author (GRA)

N71-36833# Uniroyal, Inc., Wayne, N.J.
BICOMPONENT AND BICONSTITUENT FIBERS IN BALLISTIC FABRIC FOR PERSONNEL ARMOR
M. W. Olson and G. H. Brice Apr. 1971 27 p refs
(Contract DAAG17-70-C-0032)
(AD-726918; USA-NLABS-TR-71-48-CE) Avail: NTIS CSCL 19/4

Experimental fibers have been spun from intimate mixtures of nylon, polypropylene and polyester plastics (biconstituent type) following an extensive screening program to determine compatibilities. Fibers of the bicomponent type (shell/core and bilateral) have also been spun from several combinations. A total of six combinations of both types plus a 100% nylon control have been spun in sufficient quantity to be woven into ballistic fabric and tested on a firing range. All seven fabrics showed an appreciably lower ballistic resistance (V50) than a standard nylon ballistic fabric but processing difficulties during the spinning operation may have been responsible, at least in part, for the poor showing. When comparisons are made within the series there is evidence that a shell/core fiber made from nylon and polypropylene could be developed into an improved ballistic fabric. Author (GRA)

N71-36834# Royal Aircraft Establishment, Farnborough (England).
TENSILE TESTS ON LAP JOINTS IN CARBON FIBRE REINFORCED PLASTICS
J. B. Sturgeon Aug. 1970 29 p refs
(AD-727034; RAE-TR-70159; TRC-BR-22281) Avail: NTIS CSCL 13/8

Results are presented for lap-joints tested in tension for adherends of type 1 and type 2 CFRP (carbon fibre reinforced plastics) and also for type 1 treated carbon fibre laminates with glass scrim cloth facings. The percentage of the unjointed composite load realized in the jointed specimens was sometimes higher than 50% indicating that this type of joint could be suitable for joining CFRP to itself. Author (GRA)

N71-36835# Office of Naval Research, London (England).
THE INTERNATIONAL CARBON FIBERS CONFERENCE
30 Apr. 1971 21 p Conf. held at London, 2-4 Feb. 1971
(AD-726873; ONRL-C-4-71) Avail: NTIS CSCL 11/2

The report reviews papers presented at the International Carbon Fibers Conference held in London 2-4 February 1971. Topics discussed included methods of preparation, application and property evaluation. Considerable emphasis was also placed on the role of organic matrices in composites and non-destructive testing. Several papers dealt with the commercial aspects of composites. Author (GRA)

N71-36836# Gulf General Atomic, San Diego, Calif.
LIGHTWEIGHT, LOW BALLISTIC COEFFICIENT, RADIOISOTOPE FUELED CAPSULE PROTOTYPE DEVELOPMENT PROGRAM, SUPPLEMENT B: TEST DATA AND ANALYSIS
F. D. Postula, N. B. Eisner, and M. R. Emken May 1971 84 p
(Contract AT(29-2)-2588)
(GA-9998-Suppl-B) Avail: NTIS

Details are presented of tests which were conducted to evaluate the capsule reentry coating performance. A series of simulated reentry heating (hyperthermal) tests were completed in a high enthalpy arc tunnel using 4-inch diameter tantalum alloy spherical models. Two types of coatings were investigated: pyrolitic carbon and hafnia. These were applied in various thicknesses using various application techniques. After exposure to the simulated reentry environment, materials test specimens were cut from each model to evaluate the performance of the individual coating and application. These evaluations were done for two reentry conditions: launch abort and orbital reentry. The structural integrity of each model was maintained throughout each test. Hyperthermal tests were conducted on three 8-inch diameter capsules. Two instrumented capsules were tested to obtain data on the distribution of temperatures on the fuel

container. These results were compared with those predicted with the aerothermal computer model. Author (NSA)

N71-36937 National Lending Library for Science and Technology, Boston Spa (England).
THERMODYNAMIC PROPERTIES OF GALLIUM PHOSPHIDE
A. S. Abbasov et al 1971 6 p refs Transl. into ENGLISH from Izv. Akad. Nauk. Azerb. SSR, Ser. Fiz.-Tekh. Mat. Nauk (Azerbaidzhan SSR), no. 3-4, 1967 p 48-50
(NLL-RRE-TRANS-315-(8036.625)) Avail: Natl. Lending Library, Boston Spa Engl.: 1 NLL photocopy coupon

The basic thermodynamic functions of gallium phosphide formation were investigated using the electromotive force method with a liquid electrolyte. The emfs of electrochemical cells with red and black phosphorus were measured for forward and reverse passage over a 320 to 430 K temperature range. The changes in enthalpy and entropy during the formation of gallium phosphide were determined from the functional dependence of the isober-isothermic potential on temperature. The Gibb's free energy, entropy, and energy of atomization of gallium phosphide data are compared with mass spectrometric data. J.M.

N71-36938 National Lending Library for Science and Technology, Boston Spa (England).
COMPACTIBILITY OF POWDERS
G. I. Aksenov Dec. 1970 5 p Transl. into ENGLISH from Metallokeram. Mater. izdeliya (Yerevan), 1969 p 83-90 In ENGLISH and RUSSIAN
(NLL-Trans-746-695-(9022.401); NLL-LTI-734-5447) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Techniques for determining the pressure applied to a die during powder pressing operations and the effects caused by internal friction, plastic deformation of particles, and chemical properties are presented. A numerical analysis of the various factors is developed and mathematical models of the operation are described. Author

N71-36939 National Lending Library for Science and Technology, Boston Spa (England).
BEHAVIOUR OF n-TOLUENESULPHONAMIDE DURING DEPOSITION OF NICKEL FROM A SULPHATE ELECTROLYTE
S. S. Kruglikov et al 17 Mar. 1971 4 p refs Transl. into ENGLISH from Electrokhimiya (USSR), v. 6, no. 7, Jul. 1970 p 1033-1036 In ENGLISH and RUSSIAN
(NLL-Trans-746-730-(9022.401); NLL-LTI-737-9784) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The rate of the inclusion of sulfur in a nickel deposit and the consumption of n-toluenesulphonamide (n-TSA) are discussed. All the measurements were conducted under controlled hydrodynamic conditions. With small concentration values of n-TSA, the rate of inclusion of sulfur is subordinated to the diffusion control, which gradually transfers into a compound control with the increase in concentration. The sulfur content in the nickel deposits increases with a decrease of the current density due to the decrease in the rate of cathodic surface renewal. Author

N71-36940 Washington Univ., Seattle.
FRACTURE TOUGHNESS OF FILLED POLYMERS
Allen Dale Wambach (Ph.D. Thesis) 1970 290 p
Avail: Univ. Microfilms Order No. 70-18958

The plane strain fracture toughness of glass bead filled polyphenylene oxide composites, unfilled epoxy, glass bead filled epoxy composites, and glass fiber filled epoxy composites was investigated. Primary parameters were filler concentration, adhesion of filler to polymer, testing temperature, and water immersion. Fracture toughness was measured using double edge notched tensile bars. Tensile strength and Young's modulus were obtained for use in the fracture toughness analysis. Their dependence on the major parameters was compared to the corresponding dependence of the fracture toughness. It was found that the energy required for fracture depended primarily on the ability to dissipate energy in the polymer phase. Microscopic studies of the fracture surfaces frequently revealed that rougher fracture surfaces correlated with increased fracture toughness. Dissert. Abstr.

N71-36941 Iowa State Univ. of Science and Technology, Ames.
EFFECT OF MASS TRANSFER ON THE MOTION OF A LIQUID-LIQUID INTERFACE
William Allen Scholle (Ph.D. Thesis) 1970 94 p
Avail: Univ. Microfilms Order No. 70-18904

Pressure changes induced by a change in interfacial tension on the curved interface of a static drop were used to determine the driving force and subsequent motions of the droplet interface. At any time, the drop was considered static with dynamic pressures imposed on it, including the interfacial tension change caused by the solute spreading radially from the apex of the drop along the interface and the effect of a wave propagating from the apex. The interfacial tension change was achieved experimentally by introducing a tiny drop of a cyclohexanol solution to the apex of a cyclohexane or carbon tetrachloride drop which was resting on a flat plate immersed in water. High speed motion pictures of the dynamic drops and of the corresponding motion that occurred in a flat interface were taken. Dissert. Abstr.

N71-36942 Washington Univ., Seattle.
THE EFFECT OF TIME AND TEMPERATURE ON THE MECHANICAL BEHAVIOUR OF EPOXY COMPOSITES
Arlo Ebert Moshlenpah (Ph.D. Thesis) 1970 164 p
Avail: Univ. Microfilms Order No. 70-18952

A crosslinked epoxy resin consisting of a 60/40 weight ratio of Epon 815 and Versamid 140 and composites of this material with glass beads, unidirectional glass fibers and air (foams) were tested in tension, compression, and flexure to determine the effect of time and temperature on the mode of failure, yield stress and strain, tangent and secant moduli, and stress relaxation. Strain rates ranged from .0001 to 10/min and the temperature ranged from -1 to 107 C. The material was found to change from a brittle-to-ductile-to-rubbery failure mode with the transition temperatures being a function of strain rate. filler content and filler type. Unidirectional continuous fiber filled samples were tested at fiber orientation angles of 0, 20, 45, 60 and 90 deg with respect to the stress axis. Dissert. Abstr.

N71-36943 Ohio State Univ., Columbus.
STOICHIOMETRIC AND COMPOSITIONAL EFFECTS IN CRYOCHEMICALLY PROCESSED BARIUM FERRITE CERAMICS
Robert James Miller (Ph.D. Thesis) 1970 166 p
Avail: Univ. Microfilms Order No. 70-19345

Techniques were developed for freeze drying permanent magnet materials. Material so produced was utilized in an evaluation of the effect of BaO-Fe2O3 ratio and selected dopant additions on the sintering and magnetic characteristics of barium ferrites. A process was developed for freeze drying barium ferrite materials to achieve high purity and homogeneity, starting with a chemical solution of ferric oxalate and barium acetate. A calcination temperature of 1800 F was selected, yielding an adequate pressed density while maintaining considerable reactivity. Predensification and granulation, in conjunction with a 2% polyethylene glycol binder addition, was effective in improving pressed and fired densities and subsequently the magnetic properties of the ferrite materials. The optimum BaO-Fe2O3 ratio was determined to be 1:5.5, which yielded the best sintering and magnetic characteristics. Dissert. Abstr.

N71-38944 Texas Univ., Austin.
SURFACE RHEOLOGICAL PROPERTIES OF SURFACE ACTIVE MATERIALS
Richard J. Mannheimer (Ph.D. Thesis) 1969 181 p
Avail: Univ. Microfilms Order No. 70-18317

Surface rheological methods are briefly reviewed and limitations of current theories of measurements are discussed. An improved analysis of a typical knife edge torsional viscometer is presented which estimates the additional torque due to the viscous interaction between the flowing monolayer and the substrate. Calculations based on this analysis indicate that surface viscosities reported from current torsional formulae, all of which assume that the film slips over the substrate, may be in serious error. Examples are also presented that illustrate how comparative torque measurements can lead to anomalous results when the effects of temperature on surface viscosity are being considered. An improved measurement technique, based on the viscous-traction concept, is described that makes it possible to observe and interpret both shear- and time-dependent surface rheological behavior. Dissert. Abstr.

N71-38945 California Univ., Berkeley.
ELECTROCHEMICAL STUDIES OF THE NiO-, CoO-, Fe0.95 O-Na2Si2O5 GLASS SYSTEMS
Alton Monroe Lacy (Ph.D. Thesis) 1969 101 p
Avail: Univ. Microfilms Order No. 70-17598

A high temperature galvanic cell of the type Ni/NiO, electrolyte, Me/MeO + NS2(glass) (in which the electrolyte was calcia stabilized zirconia and where Me = Fe, Co, or Ni) has been developed for the measurement of activities and other thermodynamic properties of Fe.95O, CoO and NiO in sodium disilicate glass over the temperature range 700 to 1100 C. The results indicate that these three oxides show increasing negative deviations from Raoult's Law in the order NiO, CoO, Fe.95O. The solubility limits of each oxide in sodium disilicate glass have been measured by this technique and presented as liquidus lines on proposed phase diagrams for the binary systems Fe0.95O-, CoO-, NiO-Na2Si2O5. Activities of sodium disilicate have been calculated as a function of composition and temperature by integration of the Gibbs-Duhem equation; and sodium disilicate liquidus lines have been determined by equating the calculated activities with the activity of the pure solid sodium disilicate relative to the supercooled liquid. Dissert. Abstr.

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

N71-38946*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HIGH PRECISION MOMENTS FOR THE FOURIER COEFFICIENTS OF ARBITRARY FUNCTIONS
Shalhav Zohar 1 Oct. 1971 100 p refs
(Contract NAS7-100)
(NASA-CR-122919; JPL-TM-33-460) Avail: NTIS CSCL 12A

Evaluation of the integrals from 0 to pi/2 of xi to the nth power (sin or cos kxi) d xi (n,k positive integers) is considered in detail. The difficulties in their direct evaluation are analyzed and overcome in a method capable of very high precision. A detailed error analysis yields a reliable error bound for the results obtained this way. The method has been applied in computing a table of parameters allowing the evaluation of the above integrals for n=2,3,....,201; k=1,2,....,200, with a relative error of approx 2 x 10 to the minus 40th power. Two types of tests indicate that the actual errors are well below this upper bound. At the other extreme, very simple coarse estimates of the integrals are also obtained and their error bounds established. The computed parameters are also shown to be related to the (high order) derivatives of band-limited functions and to the incomplete gamma function. Author

N71-38947*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Guidance and Control Div.
FINITE ELEMENT APPENDAGE EQUATIONS FOR HYBRID COORDINATE DYNAMIC ANALYSIS
Peter W. Likins 15 Oct. 1971 37 p refs
(Contracts NAS7-100; NAS8-26214)
(NASA-CR-122936; JPL-TR-32-1525) Avail: NTIS CSCL 12A

The increasingly common practice of idealizing a spacecraft as a collection of interconnected rigid bodies to some of which are attached linearly elastic flexible appendages leads to equations of motion expressed in terms of a combination of discrete coordinates describing the arbitrary rotational motions of the rigid bodies and distributed or modal coordinates describing the small, time-varying deformations of the appendages; such a formulation is said to employ a hybrid system of coordinates. The existing literature is extended to provide hybrid coordinate equations of motion for a finite element model of a flexible appendage attached to a rigid base undergoing unrestricted motions, and some of the advantages of the finite element approach are noted. Transformations to the modal coordinates appropriate for the general case and various special cases are provided. Author

N71-38948*# Texas A&M Univ., College Station. Inst. of Statistics.
COMPARTMENTAL ANALYSIS AND MISSING DATA TECHNIQUES IN STATIONARY TIME SERIES Final Technical Report, 1 Jun. 1969 - 31 May 1971
W. B. Smith 31 May 1971 14 p refs
(Grant NGR-44-001-097)
(NASA-CR-115201) Avail: NTIS CSCL 12A

A technique for estimating the parameters of a multivariate normal distribution from data vectors was extended to estimation problems of biological interest. The procedure groups the data according to which variates are missing, estimates the available parameters within each group, and optimally combines the estimates in a sequential fashion. The combination of parameter estimates was done so as to minimize its variance and to retain unbiased properties if possible. Techniques were developed and extended for biological applications of compartmental analysis as well. Author

N71-38949*# Massachusetts Inst. of Tech., Cambridge. Measurement Systems Lab.
THE TRANSFORMATION OF EXTERNAL HARMONIC SERIES UNDER A TRANSLATION OF ORIGIN
Stephen J. Madden, Jr. Jun. 1971 12 p refs
(Grant NGR-22-009-262)
(NASA-CR-122286; RE-68) Avail: NTIS CSCL 12A

The behavior of inverse-power spherical harmonic expansions is presented when the origin of the coordinate system undergoes a translation. A seeming paradox, involving large translations is discussed. Author

N71-38950# Auburn Univ., Ala.
BEHAVIOR OF THE SOLUTIONS OF THE DIFFERENTIAL EQUATION SECOND DERIVATIVE OF y PLUS qy TO THE p-th POWER EQUALS r
Paul Winston Spikes (Ph.D. Thesis) 28 Aug. 1970 81 p refs
Avail: NTIS

Some of the properties of the solutions of the differential equation y sup n + q(x)y sup p = r(x) are described. All quantities are assumed to be real, each of q and r is assumed to be continuous on the ray (0, infinity), and p = 2n - 1 for some positive integer n. The requirement that q and r be defined and continuous on (0, infinity) rather than on (a, infinity), a greater than or equal to 0, is not an essential restriction, but merely allows some simplification of notation and statements of results. Consequently, in some of the examples given in the following development, this requirement has been relaxed. Author

N71-38951# California Univ., Berkeley. Lawrence Radiation Lab.
RECONSTRUCTION OF THE WAVE FUNCTION FROM MATRIX ELEMENTS
Charles Garwin 14 Apr. 1971 11 p ref
(Contract W-7405-eng-48)
(UCRL-20667) Avail: NTIS

Two methods are demonstrated by which the wave functions of a system may be recovered from knowledge of the matrix elements of a complete set of observables. Author

N71-38952# Los Alamos Scientific Lab., N.Mex.
THE DIRECT SOLUTION OF THE DISCRETE POISSON EQUATION ON IRREGULAR REGIONS
B. L. Buzbee, F. W. Dorr, A George, and G. H. Golub May 1971 28 p refs
(Contracts W-7405-eng-36; AT(04-3)-326)
(LA-4553) Avail: NTIS

Several very fast and accurate direct methods were developed for solving finite difference approximations to the Poisson equations. It was shown how these algorithms for rectangular domains can be applied on irregular regions. Author

N71-38953# Hamburg Univ. (West Germany).
REGULA-FALSI PROCEDURES IN BANACH SPACES [REGULA-FALSI-VERFAHREN IN BANACHRAEUMEN]
Wolf Hofmann (Ph.D. Thesis) 1970 81 p refs In GERMAN
Avail: NTIS

A solution is constructed for the operator equation P(x) = 0 by finding the associated gradient operator P(x sub n,x' sub n) where the point x' sub n can be chosen independent of x sub n and x sub n-1. This generalized regula falsi method is a two step procedure where x' sub n = x sub n-1 produces the regula falsi and where x' sub n = x sub n produces the Newton method when the Frechet deviation P'(x) exists. The monotonous behavior of the regula falsi in half-ordered Banach spaces proves superior to the Newton method because it provides upper limits for the solution with monotonous decreases against the solution, as well as lower limits with monotonous increases against the solution. Transl. by G.G.

N71-38954# Technische Hochschule Carolo Wilhelmina, Brunswick (West Germany).
ON AN ORDERING RELATIONSHIP FOR ULTRAFILTERS [UEBER EINE ORDNUNGSRELATION FUER ULTRAFILTER]
Peter Sperner (Ph.D. Thesis) 1971 45 p refs In GERMAN
Avail: NTIS

Topological properties of ultrafilters are considered. It is shown that two ultrafilters with the same basis are equivalent if bijective conformal transformations of the basic quantity lead to their diffusion into each other. An ordering relationship established that each projection that produces an ultrafilter on itself agrees in one filter density with the identical topology. Transformations that project one ultrafilter onto an equivalent one are characterized by their injectivity into one filter density. Numerous classes of primitive ultrafilters exist according to the continuum hypothesis. Transl. by G.G.

N71-38955# Technische Hochschule Munchen (West Germany). Fakultaet fuer Allgemeine Wissenschaften.
EVALUATION OF SELF COUPLED RELATIVISTIC SCALAR FIELD WITH FUNCTIONAL METHODS [UNTERSUCHUNG EINES SELBSTGEKOPPELTEN RELATIVISTISCHEN SKALARFELDES MIT FUNKTIONAL METHODEN]
Erhard Seiler (Ph.D. Thesis) 1971 78 p refs In GERMAN
Avail: NTIS

The Schwinger functional equation for the charged phi 4 theory with bilocalised exterior sources is studied by replacing the space-time continuum with a discrete multiplicity. Solutions are transferable to a field theory with ultraviolet cutoff; the difficulties developing at removal of the cutoff are avoided through formal infinite renormalizations. Special emphasis is placed on the correlation between perturbation theory and exact solutions. Transl. by G.G.

N71-38956# Fort Detrick, Frederick, Md. Systems Analysis Div.
STRUCTURE OF A NOMOGRAPH AND SLIDE RULE METHODOLOGY USEFUL IN CHARACTERIZING EXPONENTIAL DECAY
Robert L. Steerman Jun. 1971 65 p refs
(AD-726934; SMUFD-TM-231; AMXFD-AE-T-49869; CMS-6850) Avail: NTIS CSCL 12/1

The structure of a nomograph for estimating the parameters of exponential decay is described, with its mathematical and graphical bases. An example is given of the type of nomograph and its use is illustrated with a set of sample problems. The suggested structure is compared with that of one previously published by Bourdillon and Lidwell. An alternative useful methodology for parameter estimation involving log scales on a slide rule is included. Author (GRA)

N71-38957# Istituto di Fisica Dell Atmosfera, Rome (Italy).
PRACTICAL QUESTIONS REGARDING THE USE OF MIE SHOCK WAVES FOR SPHERICAL PARTICLES [QUESTIONI PRATICHE RIGUARDANTI L'USO DELLA SEZIONE D'URTO DI MIE PER PARTICELLE SFERICHE]
R. Ferrara and G. Tonna 1970 16 p refs In ITALIAN
Presented at the 18th Conf. of the Assoc. Geofis. Ital., Naples, 1-4 Oct. 1969
(IFA-CP-224) Avail: NTIS

A description of the Mie theory for spherical homogeneous and isotropic particles is presented along with a critical list of the existing numerical tables of cross sections. Interpolation methods for the extension of the tables, and the programs for direct computation of the cross section are discussed. Author

N71-38958# Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
NUMERICAL SOLUTIONS BY THE CONTINUATION METHOD
E. Wasserstrom May 1971 30 p refs
(TAE-123) Avail: NTIS

The continuation method is described with a special emphasis on its suitability for numerical solutions on fast computers. Three problems are treated in detail: finding roots of a polynomial, boundary value problems of nonlinear equations, and eigenvalue problems of linear ordinary differential operators. Numerical results are given for these problems. Finally, the continuation method is compared to iterative methods and several schemes which combine them are proposed. Author

N71-38959# Manchester Univ. (England). Statistical Lab.
THE QUASI-STATIONARY DISTRIBUTIONS OF QUEUES IN HEAVY TRAFFIC
E. K. Kyprianou Aug. 1971 27 p refs
(RR-29/EKK/4) Avail: NTIS

The quasi-stationary distributions of a queue are studied for the case when its traffic intensity is below the critical value one, but only just, a situation that is called heavy traffic. The main conclusion is that for both the M/G1 and GI/M/I queues, if W sub T is the equilibrium virtual waiting time conditional on it still being in the first busy period, then the distribution of W sub T is asymptotically, as the traffic intensity tends to be one, gamma with two degrees of freedom and mean 4m, where m is the inter-arrival time variance plus service time variance divided by 2(mean inter-arrival time - mean service time). The same conclusion applies to the queue size process Q(t) with the slight difference that the asymptotic gamma distribution has mean 4m/mean inter-arrival time. Author

N71-38960# Manchester Univ. (England). Statistical Lab.
A NUMBER-THEORETIC CLASS OF WEAK BERNOULLI TRANSFORMATIONS

S. M. Rudolfer and K. M. Wickinson Aug. 1971 20 p refs
(RR-28/SMR/2/KMW/1) Avail: NTIS

The classification problem in ergodic theory is considered. It is shown that for an automorphism to belong to an equivalent class of Bernoulli automorphisms, it is sufficient that it satisfies one of several asymptotic independence properties. The closest to independence is weak Bernoulli. Author

N71-36961# Manchester Univ. (England). Statistical Lab.
ON THE QUASI-STATIONARY DISTRIBUTIONS OF THE GI/M/1 QUEUE
E. K. Kyprianou May 1971 19 p refs
(RR-27/EKK/3) Avail: NTIS

Explicit results are obtained for the quasi-stationary distributions of the waiting time process Y(t) defined by Prabhu, the queue size process Q(t), and the virtual waiting time process W(t) associated with the GI/M/1 queue. J.G.M.

N71-36962# New York Univ., N.Y. Dept. of Mathematics.
LEIBNIZ RULE, THE CHAIN RULE, AND TAYLOR'S THEOREM FOR FRACTIONAL DERIVATIVES
Thomas Joseph Osler (Ph.D. Thesis) Feb. 1970 85 p refs
Avail: NTIS

A fractional differential operator is an extension of the familiar operator d sup n = d sup n divided by d z sup n in which n can assume non-integral values. Three elementary formulas from the calculus are generalized to include fractional derivatives: (1) the Leibniz rule for the derivative of the product of two functions, (2) the chain rule for the derivative of a composite function, and (3) Taylor's theorem for the expansion of a function in a power series. Each of the three generalized results is applied to the study of the special functions of mathematical physics. New relations among these functions, and simpler derivations of known results are obtained. Author

N71-36963# Maryland Univ., College Park. Dept. of Physics and Astronomy.
FINITE ENERGY SUM RULES ON HYPERBOLAS, 1
O. W. Greenberg and J. C. Sandusky Jul. 1971 11 p refs Submitted for publication
(Grant NSF GP-8748)
(TR-72-011) Avail: NTIS

Dispersion relations and finite energy sum rules on hyperbolas are derived in the real Mandelstam plane which are asymptotic to lines of fixed s and u, with an ellipse on which s and u are complex. These finite energy sum rules on hyperbolas are applied to backward and near-backward pion nucleon scattering. Author

N71-36964# Maryland Univ., College Park. Dept. of Physics and Astronomy.
FINITE ENERGY SUM RULES ON HYPERBOLAS, 2
J. C. Sandusky Jul. 1971 35 p refs Submitted for publication
(Grant NSF GP-8748)
(TR-72-012) Avail: NTIS

The finite energy sum rules on hyperbolas is reduced into a set of integral constraints for the reaction antinucleon-nucleon yields pion-pion. These sum rules provide information of the first eight partial waves for this reaction. Zeroes above threshold are found for almost all partial waves; also strong evidence for background or daughters in the lower ones. For J = 4 and 5, daughters are less evident. Application to Regge residue parameters for P and rho suggest these residues turn over at large, positive t but do not change sign. Values for the P residues indicate the A(+) amplitude does not satisfy an unsubtracted dispersion relation. Author

N71-36965# RAND Corp., Santa Monica, Calif.
TURAN'S THEOREM FOR k-GRAPHS
Joel Spencer Jul. 1971 7 p refs Revised
(P-4648-1) Avail: NTIS

Let 2 less than or equal to k less than or equal to b less than or equal to n be positive integers. Denoted is by T(n, k, b) - T for Turan - the smallest q such that there exists a k-graph with n vertices, q edges, and with no independent set of size b. In other words, T(n, k, b) is the smallest number of k-subsets of an n-set V such that every b-subset of V contains at least one of these subsets. Author

N71-36966# Academy of Sciences of the Ukranian SSR, Kiev (USSR). Institute for Theoretical Physics.
EXACT CONFORMALLY-PLANE SOLUTION OF THE EINSTEIN EQUATIONS FOR THE NONSTATIC AXIAL FIELD SYMMETRY
N. P. Bondarenko and P. K. Kobushkin 1969 31 p refs In ENGLISH; RUSSIAN summary
(ITF-69-61) Avail: NTIS

The exact solution for the equations of the general theory of relativity for the case of the conformally-plane field of the nonstatic axial symmetry is found. It is shown that the obtained equation: (1) can describe the metric of the non-static anisotropic material model with the homogeneous distribution of the matter and the inhomogeneous distribution of pressure; (2) allows the possibility of the oscillations with the existence of the regular minimum of radius of the corresponding model; and (3) in the limiting case, the solution describes the non-static cosmological Einstein-Sitter's model. The axial character of the model is connected with the postulated density of the field angular momentum. Author

N71-36967*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AVERAGING METHOD FOR THE SOLUTION OF NONLINEAR DIFFERENTIAL EQUATIONS WITH PERIODIC NONHARMONIC SOLUTIONS
Ferdinand F. Cap Sep. 1971 18 p refs
(NASA-TM-X-65710; X-640-71-396) Avail: NTIS CSCL 12A

An averaging technique similar to that of Kyrlov and Bogolyubov but using Jacobi elliptic functions is presented. These functions are also periodic and are exact solutions of strong nonlinear differential equations. The method is used to solve nonlinear differential equations with linear and nonlinear small dissipative terms and/or with time dependent parameters. It is also shown that quite general dissipative terms can be transformed into time-dependent parameters. As a special example, the Langevin (collisional) equation of motion of electrons in a neutralizing ion background under the influence of a time and space-dependent electric field is presented. The method may also be used for nonlinear control theory, dynamic and parametric stabilization of nonlinear oscillations in plasma physics. Author

N71-36968 National Lending Library for Science and Technology, Boston Spa (England).
CHOICE OF THE DEGREE OF A POLYNOMIAL TO SMOOTH RESULTS OF MEASUREMENTS
V. S. Kiricuk 2 Mar. 1971 9 p refs Transl. into ENGLISH from Akad. Nauk Sibirsk. SSR, Otd., Avtometrija (Novosibirsk), no. 3, 1970 p 26-31
(NLL-M-20367-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

An optimum estimate for the degree of the approximating polynomial is obtained on the assumption that limits are imposed on the degree. The method is based on a previously published method in which the problem is reduced to testing a multiple hypothesis, and an optimum estimate of the degree is given by a sequential procedure which tests whether the coefficients of the polynomial are equal to zero, beginning with the coefficient of the highest possible power. In the present method, the accuracy of the estimate in the region of the lowest possible powers is higher than that given by the earlier method. Author

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N71-36989*# GCA Corp., Bedford, Mass. GCA Technology Div.
INVESTIGATION OF TEMPORAL VARIATIONS OF WINDS Final Report
J. Bedinger and E. Constantinides Aug. 1971 42 p
(Contract NAS6-21036)
(NASA-CR-122648; GCA-TR-71-3-N) Avail: NTIS CSCL 04B

The analysis of upper atmospheric wind data obtained from vapor trails is discussed. A restricted model appropriate to the observation site (Wallops Island, Virginia) was constructed in order to investigate the physical properties of the atmosphere which are implied by the observed winds. The model utilizes the approximation of a plane-stratified atmosphere and allows derivation of formulas which express the variation of the density, pressure, temperature, and heating rates as a function of the observed winds. A perturbation method is used to estimate the magnitude of the nonlinear, second order terms which result from the main diurnal mode between 80 and 100 km. Variation of 3 percent of the first order pressure value to 9 percent of the temperature were found. It is concluded that the data from a small number of sequential observations will allow an adequate description of the total wind variations only if the altitude and time variations are analyzed simultaneously. It is proposed that such methods be developed. It is further proposed that vapor trail measurements be closely coordinated with various other observations and that the method be extended for daytime usage. Author

N71-36970*# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
VERTICAL MOMENTUM TRANSPORT OVER MOUNTAINOUS TERRAIN
Gene L. Wooldridge Sep. 1970 104 p refs *Its* Atmospheric Sci. Paper No. 164
(Contract NAS9-10306)
(NASA-CR-115188) Avail: NTIS CSCL 04B

High-resolution pictures from Apollo 9 were utilized to map the areal extent of gravity waves over the southwestern United States. The orientation of cumulus streets and cirrus streaks augmented conventional wind data for momentum and kinetic energy calculations. Zonal shearing stress gradients in stably stratified air flowing over rugged mountainous terrain indicated very large subgrid-scale vertical fluxes of zonal momentum. Maximum stress values of several tens of dynes/sq cm occurred in the lower tropospheric layers where the air flow encountered the high Rocky Mountains of central New Mexico. The vertical fluxes of zonal momentum were directed upward to tropopause levels when extensive areas of gravity waves covered eastern Arizona, New Mexico, and western Texas. The potential energy contained in the wave population attained values through the troposphere as high as 930,000 joules/sq m. The residual dissipation term in the kinetic energy budget indicated a subgrid-scale flux of energy downward from the lower stratosphere concurrent with the upward flux of zonal momentum. Author

N71-36971*# National Oceanic and Atmospheric Administration, Silver Spring, Md. Upper Air Branch.
WEEKLY SYNOPTIC ANALYSES 5-, 2-, AND 0.4-MILLIBAR SURFACES FOR 1968 (BASED ON METEOROLOGICAL ROCKETSONDE AND HIGH LEVEL RAWINSONDE OBSERVATIONS)
May 1971 173 p refs
(NASA Order P-44664G)
(NASA-CR-122938; NOAA-TR-NWS-14) Avail: NTIS; SOD $1.50 CSCL 04B

Data from meteorological rocketsonde and rawinsonde observations were employed to analyze a series of high altitude synoptic charts. Methods employed for processing the various types of data and the analysis procedure used are described. Broad-scale analyses of the 5-, 2-, and 0.4-mb surfaces, primarily covering North America and adjacent ocean areas, are presented at weekly intervals for 1968. A brief discussion of the height and temperature fields is also given. Circulation and temperature changes associated with a major stratospheric warming during January are among the discussion items. Author

N71-36972# Danish Meteorological Inst., Charlottenlund.
METEOROLOGICAL YEARBOOK. PART 1: DENMARK AND FAROE ISLANDS (EXCEPT GREENLAND), 1965 [METEOROLOGISK ARBOG. 1. DEL: DANMARK OG FAEROERNE (UNDTAGEN GROENLAND), 1965]
1971 94 p refs In DANISH and ENGLISH
(ISBN-87-7478-025-3) Avail: NTIS

Tabulated meteorological data for 1965 are presented for Denmark and the Faroe Islands. Monthly and annual summaries are given for parameters including atmospheric pressure and temperature, wind velocity, humidity, cloud cover, and precipitation. Climatic maps of monthly mean temperatures and precipitation in Denmark are also included. J.M.

N71-36973# Atlantic Oceanographic and Meteorological Labs., Miami, Fla.
COLLECTED REPRINTS, 1969, VOLUME 2
Sep. 1970 546 p refs Prepared in cooperation with Pacific Oceanog. Lab.

Summary data are presented on the results of scientific and technical work on experimental meteorology and physical oceanography. For Volume 1, see N71-30980. For individual titles, see N71-36974 through N71-37010.

N71-36974# Environmental Science Services Administration, Washington, D.C.
TROPICAL CLOUDINESS AND RAINFALL RELATED TO PRESSURE AND TIDAL VARIATIONS a13
G. W. Brier and Joanne Simpson *In* Atlantic Oceanog. and Meteorol. Labs. Collected Reprints, 1969, Vol. 2 Sep. 1970 28 p refs Repr. from Quart. J. Roy. Meteorol. Soc. (England), v. 95, no. 403 p 120-147 (See N71-36973 23-20)
Avail: SOD $3.75

A definitive statistical relationship is established between tropical cloudiness and rainfall and the semidiurnal solar S sub 2 atmospheric tide, as manifested in the semidiurnal surface pressure variation. Pressure and weather data are used from Batavia (seventy years) and Wake Island (twelve years). The S sub 2 is shown to enhance cloudiness and rain near sunrise and sunset, and to suppress them shortly after midday and midnight. The analysis is based on (a) the fact that the S sub 2 amplitude varies by 15 to 20 per cent between months and by more than 100 per cent from day to day and (b) the amplitude of the S sub 2 wave as computed from the pressure data at a station is closely related to the 5 to 6 hourly pressure changes during the periods around 4 to 5 a.m. to 10 a.m. from 10 a.m. to 4 p.m., etc. The crux of the analysis is the demonstration that days with large 5 to 6 hourly pressure changes during these periods have large cloudiness changes during these same periods relative to days with small 5 to 6 hourly pressure changes. Possible mechanistic connections between S sub 2 pressure tendencies and cloud properties are examined. Large-scale simultaneous pressure changes over the Pacific Ocean area are shown and related to cloudiness changes. Author

N71-36975# Atlantic Oceanographic and Meteorological Labs., Miami, Fla. Experimental Meteorology Lab.
THE EFFECT OF RAINFALL OF CLOUD CONDENSATION NUCLEI FROM VEGETATION FIRES OVER SOUTH

FLORIDA DURING SPRING DROUGHT
Ronald L. Holle *In its* Collected Reprints, 1969, Vol. 2 Sep. 1970 64 p refs (See N71-36973 23-20)
(ESSA-TM-ERLTM-AOML-4) Avail: SOD $3.75

Consideration of the vegetation cover in southern Florida led to the choice of four sources of most smoke particles produced during droughts: (1) muck (peat), (2) algae, (3) saw grass, and (4) mixed leaves from common trees and bushes. These were burned at 0.75 percent supersaturation in the laboratory and all were found to produce between 10 to the 9th and 10 to the 10th power nuclei per g burned. A sample calculation assuming reasonable burn rates for these materials resulted in 4600 cloud condensation nuclei/cm when mixed uniformly to cloud base. The extreme dryness between 1 April and 15 May of 1967 over Florida was found to be related predominantly to synoptic-scale lag in rainfall caused by lingering cloud condensation nuclei from fires, since dynamic causes easily explain the timing of rainfall. Individual cloud rainfall may have been affected by high cloud condensation nuclei counts, as suggested by cumulus height populations and cumulus model calculations. Liquid water fallout from small clouds is effected to a greater degree than from tall clouds. Author

N71-36976# Environmental Science Services Administration, Coral Gables, Fla.
OBSERVATIONS AND COMMENTS ON TWO SIMULTANEOUS CLOUD HOLES OVER MIAMI
H. M. Johnson and Ronald L. Holle *In* Atlantic Oceanog. and Meteorol. Labs. Collected Reprints, 1969, Vol. 2 Sep. 1970 5 p ref Repr. from Bull. Amer. Meteorol. Soc., v. 50, no. 3 p 157-161 (See N71-36973 23-20)
Avail: SOD $3.75

A pair of large, almost perfectly circular cloud holes are described which were observed and photographed during their formation, growth and dissipation directly over Miami, Fla., on 1 December 1967. The two holes formed in a rather high and thin layer of altocumulus (altocumulus stratiformis translucidus perlucidus), a water droplet cloud. The Miami radiosonde data for 1200 GMT indicate a temperature inversion and a moisture maximum at about 450 mb, or 21,000 ft, the estimated height of the cloud layer. At this level the temperature was about -16 C, and the wind was from the West-Northwest with a speed of 25 to 30 kt. The ESSA 6 satellite picture for about 1545 GMT showed the presence of a rather indistinct formation of thin middle clouds mainly east of Miami which were connected with the western limit of a narrow, oceanic, cold frontal cloud band. Author

N71-36977# Environmental Science Services Administration, Silver Spring, Md.
THE TRANSPORT OF MOISTURE INTO THE ANTARCTIC INTERIOR
B. Lettau *In* Atlantic Oceanog. and Meteorol. Labs. Collected Reprints, 1969, Vol. 2 Sep. 1970 10 p refs Repr. from Tellus (Sweden), v. 21, no. 3 p 331-340 (See N71-36973 23-20)
Avail: SOD $3.75

The magnitude of the moisture transport by the atmosphere into the Antarctic interior is determined from a mass transport model which allows a longitudinal variation in the annual flux values. It is indicated that the use of monthly mean transport and temperature values underestimates the annual moisture transport required by observed accumulation values in the interior, consequently a relatively much larger fraction of the annual moisture transport must occur in conjunction with positive temperature deviations from mean monthly values. This relation was examined at Byrd station where it was found that during the austral summer 1957-8 the threeday period with the highest 700 mb temperature accounted for nearly 20% of the annual moisture transport. The variation of the moisture transport with altitude is examined and its effect as a constraint upon the maximum central height that the ice sheet may attain is briefly discussed. Author

N71-36978# Environmental Science Services Administration, Silver Spring, Md.
WIND STRUCTURE IN THE EQUATORIAL MARITIME FRICTION LAYER
B. Lettau *In* Atlantic Oceanog. and Meteorol. Labs. Collected Reprints, 1969, Vol. 2 Sep. 1970 5 p refs Repr. from Arch. Meteorol., no. 4 p 30-34 (See N71-36973 23-20)
Avail: SOD $3.75

The vertical wind structure in the equatorial maritime friction layer is related to parameters derived from pressure and density gradients, frictional stresses, and the rotation of the earth. The analytic expressions for the free-air wind and wind shear, obtained by latitudinal differentiation of the geostrophic approximation, were used to define surface wind components analogous to the midlatitude surface geostrophic wind and geostrophic deviation vectors. The free-air wind and vertical wind shear vectors were determined by macro-scale meteorological patterns which are persistent for relatively long periods of time. The vertical wind structure of the equatorial friction layer was determined by the momentum exchange mechanism at the air-sea interface and by local synoptic temperature (density) variations. The use of the latitudinal gradients of the coriolis force and the pressure gradient force obviates the problem of a vanishing coriolis parameter at the equator, and as a result the model in its detailed application is analogous to that of the wind structure in an extra-tropical baroclinic boundary layer. The model is tested with observed surface temperature values and wind profiles obtained in the Arabian Sea by the 1967 Oceanographer expedition, and in the equatorial Atlantic Ocean by the 1925-7 Meteor expedition. Relevant climatological pressure and temperature fields were taken from published summaries and atlases. Author

N71-36979# Environmental Science Services Administration, Silver Spring, Md.
ON THE KINETIC ENERGY SPECTRUM NEAR THE GROUND
Albion Taylor and Abraham H. Oort *In* Atlantic Oceanog. and Meteorol. Labs. Collected Reprints, 1969, Vol. 2 Sep. 1970 14 p refs Repr. from Mon. Weather Rev., v. 97, no. 9, Sep. 1969 p 623-636 Revised (See N71-36973 23-20)
Avail: SOD $3.75

For six stations in the Northeastern United States, the spectrum of horizontal wind speed was analyzed using 10 yr of 1-min averaged, hourly surface reports. The fast Fourier transform technique was employed to estimate the spectrum between 1 cycle/2 hr and 1 cycle/2 yr. The kinetic energy spectra show two major spikes at periods of 24 hr and 1 yr. However, most of the energy is contained in the traveling cyclones and anticyclones with periods between 2 and 7 days. The apparent discrepancy between Van der Hoven's results and these results concerning the existence of an important diurnal cycle in the kinetic energy can be explained by Blackadar's theory of the diurnal wind variation with height. Van der Hoven's spectrum represents conditions near the top of the surface layer, while these data were taken well within the surface layer. A line-by-line investigation of the diurnal peak reveals a very sharp line at 2400 hr with two side lobes 3.9 min away from the main line. These side lobes are probably caused by an annual modulation of the diurnal cycle. The spectra tentatively corrected for aliasing give some indication of the existence of a spectral gap between small-scale turbulence and mesoscale phenomena. Author

N71-36980# Environmental Science Services Administration, Coral Gables, Fla. Atmospheric Physics and Chemistry Lab.
THE IMPORTANCE OF NATURAL GLACIATION ON THE MODIFICATION OF TROPICAL MARITIME CUMULI BY SILVER IODIDE SEEDING
Robert I. Sax *In* Atlantic Oceanog. and Meteorol. Labs. Collected Reprints, 1969, Vol. 2 Sep. 1970 13 p refs Repr. from J. Appl. Meteorol., v. 8, no. 1, Feb. 1969 p 92-104 Revised (See N71-36973 23-20)
Avail: SOD $3.75

A detailed study was made of the clouds observed during the 1965 Project Stormfury experiments. From photographic coverage, notes on visual observations, and instrumentation on-board penetrating aircraft, data were compiled on cloud liquid-water content, volume-median drop size, in-cloud temperature profile, and the dynamical life histories of both seeded and nonseeded clouds. The validity of applying Koenig's numerical splintering model to tropical maritime cumuli, as well as an assessment of the effectiveness of silver iodide seeding, were determined by comparing the dynamical behavior of paired seeded and nonseeded clouds with glaciation times predicted by the model. Dynamical studies were initiated on two independently developed parametrized numerical cumulus models, and an excellent correlation between predicted and observed cumulus growth was found if no natural glaciation at temperatures >-15C was assumed. The results suggest that natural glaciation does not proceed rapidly and/or extensively enough in the critical cloud updraft areas to alter the effectiveness of modifying tropical maritime cumuli by causing artificial glaciation with silver iodide. Author

N71-36981# Environmental Science Services Administration, Coral Gables, Fla. Experimental Meteorology Lab.
CLOUD BUILDING AND BREAKING
Joanne Simpson *In* Atlantic Oceanog. and Meteorol. Labs. Collected Reprints, 1969, Vol. 2 Sep. 1970 10 p Repr. from Med. Opinion and Rev., v. 5, no. 10, Oct. 1969 p 39-58 (See N71-36973 23-20)
Avail: SOD $3.75

A brief history is given of the development of cloud seeding technology. The basic principles involved in cloud growth and the effects of seeding are discussed. Several cloud seeding experiments and applications are summarized. J.M.

N71-36982# Environmental Science Services Administration, Coral Gables, Fla.
ON SOME ASPECTS OF SEA-AIR INTERACTION IN MIDDLE LATITUDES
Joanne Simpson *In* Atlantic Oceanog. and Meteorol. Labs. Collected Reprints, 1969, Vol. 2 Sep. 1970 28 p refs Repr. from Deep-Sea Res. (London), v. 16, suppl. 447, 1969 p 233-361 (See N71-36973 23-20)
Avail: SOD $3.75

Sea-air exchange which is related to travelling frontal cyclones in middle-latitudes and the distribution of energy and momentum transfer relative to the cyclone model is described. The role of sea-air exchange in cyclogenesis is analyzed in terms of the concentration and production of vorticity. Observational cases are supplemented by numerical model results. It is tentatively concluded that the direct effect of oceanic heating upon cyclone growth is small but that the indirect effect, via convection, may be very large. An attempt is made to analyze how and under what conditions turbulent exchange sustains deep convection and how, in turn, the convection acts to produce or enhance cyclone development. Author

N71-36983# Environmental Science Services Administration, Miami, Fla. Atmospheric Physics and Chemistry Lab.
MODELS OF PRECIPITATING CUMULUS TOWERS
Joanne Simpson and Victor Wiggert *In* Atlantic Oceanog. and Meteorol. Labs Collected Reprints, 1969, Vol. 2 Sep. 1970 19 p refs Repr. from Mon. Weather Rev., v. 97, no. 7, Jul. 1969 p 471-489 Revised Sponsored in part by Bur. of Reclamation (See N71-36973 23-20)
Avail: SOD $3.75

A model of the growth of cumulus clouds is presented. The water content and maximum height of rising towers are calculated using a buoyancy equation with consideration of the effects of entrainment and water load. The latter is subject to effects of modeled microphysical effects. Precipitation growth is parameterized in terms of an autoconversion equation and a collection equation. A precipitation fallout scheme is devised that depends on water content, drop spectrum, and the vertical rise rate of the tower. Freezing subroutines are devised to model the effects of silver-iodide seeding. A hierachy of seeding routines, using different ice collection efficiencies and terminal velocities, is partially tested against the data of the Stormfury 1965 tropical cumulus-seeding experiment. Some preliminary numerical experiments on warm clouds are performed, assuming changes in drop spectra from hygroscopic seeding. Author

N71-36984# Environmental Science Services Administration, Coral Gables, Fla. Experimental Meteorology Branch.
INTENSIVE STUDY OF THREE SEEDED CLOUDS ON 16 MAY 1968
Joanne Simpson and William L. Woodley *In* Atlantic Oceanog. and Meteorol. Labs. Collected Reprints, 1969, Vol. 2 Sep. 1970 44 p refs (See N71-36973 23-20)
(ESSA-TM-ERLTM-APCL-8) Avail: SOD $3.75

The history of three cumulus clouds which were seeded over the south Florida peninsula on 16 May 1968 is analyzed with aircraft and ground radar observations and a parameterized numerical model. Observations and cloud measurements, which were made by a DC-6 and B-57 are described. Quantitative photography and in-cloud records of temperature, humidity, and water content were analyzed. Photogrammetry with the airborne cameras was performed to obtain the heights and sizes of the clouds as a function of time. The numerical model predicts the rise rate, cloud and precipitation water contents, and radar echo intensity of a rising cloud tower. The calibrated ground radars were used in conjunction with the aircraft penetrations to test the model predictions. The model was found to predict all parameters effectively in the case of liquid clouds. Author

N71-36985# Environmental Science Services Administration, Boulder, Colo. Atmospheric Physics and Chemistry Lab.
AN AIRBORNE PYROTECHNIC CLOUD SEEDING SYSTEM AND ITS USE
Joanne Simpson, William L. Woodley, Howard A. Friedman, Thomas W. Slusher (Olin Mathieson Chem. Corp.), R. S. Scheffee (Atlantic Res. Corp.) et al *In* Atlantic Oceanog. and Meteorol. Labs. Collected Reprints, 1969, Vol. 2 Sep. 1970 47 p refs (See N71-36973 23-20)
(ESSA-TM-ERLTM-APCL-5) Avail: SOD $3.75

The development, testing, and use of an airborne pyrotechnic cloud seeding system is described. Pyrotechnic flares producing 50 g of silver iodide smoke each were developed and tested for nucleation effectiveness in a cloud chamber. Night flight tests were made of the delivery rack and firing system reliability, burn time, and flare trajectory. A randomized seeding scheme was used on 19 supercooled cumuli, of which 14 were seeded and 5 were controls. Of the 14 seeded clouds, 13 grew explosively. Seeded clouds grew 10,900 ft higher than the controls, with the difference significant at better than the 1/2 percent level. Rainfall from seeded and control clouds were compared by means of calibrated ground radars. Large increases in rainfall were found from seeded clouds, but not at a satisfactory level. Author

N71-36986# Atlantic Oceanographic and Meteorological Labs., Miami, Fla.
PRECIPITATION RESULTS FROM A PYROTECHNIC CUMULUS SEEDING EXPERIMENT
William L. Woodley *In its* Collected Reprints, 1969, Vol. 2 Sep. 1970 53 p refs (See N71-36973 23-20)
(ESSA-TM-ERLTM-AOML-2) Avail: SOD $3.75

In an attempt to specify the changes in precipitation produced by alteration of cloud dynamics, airborne seeding with silver iodide pyrotechnics was carried out in south Florida during May 1968. Emphasis was placed on altering cloud dynamics and on increasing precipitation as a by-product of the dynamic alteration. Nineteen clouds were studied; 14 were seeded and 5 unseeded (controls) as dictated by the randomized seeding instructions. Each of the 14 clouds received approximately 1 kg of silver iodide smoke. Seeding was found to be effective in promoting increased cloud growth; the average growth

difference between the seeded and control clouds was 11,400 ft, significant at the 1 percent level. The induced growths took many forms and in many cases were produced in clouds containing significant amounts of natural ice. A 10-cm radar with iso-echo contouring was used to infer changes in precipitation. Analysis indicates that seeding increased rainfall on average of 100 to 150 acre-feet 40 min after the seeding pass, an increase of over 100 percent. Author

N71-36987# Atlantic Oceanographic and Meteorological Labs., Miami, Fla. Experimental Meteorology Lab.
A RAIN GAGE EVALUATION OF THE MIAMI REFLECTIVITY RAINFALL RATE RELATION
William L. Woodley and Alan Herndon *In its* Collected Reprints, 1969, Vol. 2 Sep. 1970 18 p refs (See N71-36973 23-20)
(ESSA-TM-ERLTM-AOML-3) Avail: SOD $3.75

Fifty comparisons were made between shower rainfall recorded by rain gages and observed with radar to evaluate the reflectivity (Z) -- rainfall rate (R) relation, Z = 300R to the 1.4th power, referred to as the Miami Z-R relation. Total shower rainfall measured by recording rain gages was compared with estimates derived from the Miami Z-R relation in conjunction with radar reflectivity measurements with iso-echo contouring and the analysis scheme. The radar and rain gage estimates of shower rainfall were highly correlated and differed an average of between 8 and 30 percent. Stratification by shower amount revealed that the radar estimate of gage-recorded rainfall was too high for small shower amounts (< 0.25 in.) and too low for large shower amounts. Stepwise regression analysis showed that consideration of the square of the range from gage to radar made a small (3 percent) but statistically significant (< 1 percent level) reduction in the variance and improved the correlation (0.93 to 0.944) between the gage and radar estimates of precipitation. It is concluded that the Miami Z-R relation, when used with the radar system, is an effective tool in representing point and areal rainfall from southern Florida convective showers. Author

N71-36988# Atlantic Oceanographic and Meteorological Labs., Miami, Fla. Experimental Meteorology Lab.
LARGE SCALE PRECIPITATION EFFECTS OF SINGLE CLOUD PYROTECHNIC SEEDING
William L. Woodley, A. Herndon, and R. Schwartz *In its* Collected Reprints, 1969, Vol. 2 Sep. 1970 29 p refs (See N71-36973 23-20)
(ESSA-TM-ERLTM-AOML-5) Avail: SOD $3.75

The large-scale precipitation effects of single cloud pyrotechnic seeding in southern Florida during May 1968 were investigated. Rainfall over areas traversed by the silver iodide plume was compared with that over areas not affected by the plume, and radar rainfall over a circular grid centered on the core of the seeded clouds was compared with grid rainfall centered on the nonseeded experimental clouds. Analysis techniques are described with their limitations and uncertainties. The results are not conclusive. Although single cloud silver iodide pyrotechnic seeding caused increased growth and precipitation from the seeded clouds during May 1968, the large scale precipitation effects during this period, while positive, were apparently too small to be significant. Author

N71-36989# Environmental Science Services Administration, Coral Gables, Fla. Experimental Meteorology Branch.
RADAR AND PHOTOGRAPHIC DOCUMENTATION OF CONVECTIVE DEVELOPMENTS ON 16 MAY 1968
William Lee Woodley and Jose Fernandez Partagas *In* Atlantic Oceanog. and Meteorol. Labs. Collected Reprints, 1969, Vol. 2 Sep. 1970 19 p refs (See N71-36973 23-20)
(ESSA-TM-ERLTM-APCL-7) Avail: SOD $3.75

The convective developments over southern Florida on May 16, 1968, are documented to provide a basis for comparison for seeded cloud behavior on that day. Ground-based 10-cm radar observations, concurrent aerial time lapse photography, and an ESSA satellite picture are used in the documentation. Large convective clouds developed in a band near a preexisting cloud line that stretched from the Gulf of Mexico to Miami. Four cumulonimbus clouds formed in this band: two were natural and the other two were apparently artificially induced. By late afternoon several other small cumulonimbus clouds were scattered over the southern portion of the peninsula. Seeding probably induced two of the cumulonimbi studied, which, once formed, behaved like their natural counterparts. The natural and artificially induced cumulonimbi were similar in appearance and had comparable lifetimes and radar echoes. Author

N71-36990# Society of Motion Picture and Television Engineers, Inc., New York.
CLOUD PHOTOGRAMMETRY FROM AIRBORNE TIME LAPSE PHOTOGRAPHY c14
Luis M. H. Cantilo (Miami Univ.) and William L. Woodley (Miami Univ.) *In* Atlantic Oceanog. and Meteorol. Labs. Collected Reprints, 1969, Vol. 2 Sep. 1970 11 p refs Presented at 105th Tech. Conf., 20-25 Apr. 1969 Sponsored by ESSA Its Preprint No. 105-52 (See N71-36973 23-20)
Avail: SOD $3.75

The technique used to analyze the aerial cloud photographs, process the Doppler navigational information, and obtain the desired measurements of the clouds is described. The various problems inherent in this method are considered, and results of its application are presented. Author

N71-36991# Environmental Science Services Administration, Norfolk, Va.
FIELD OCCURRENCES OF INDUCED MULTIPLE GRAVITY WAVES c13
Robert J. Byrne *In* Atlantic Oceanog. and Meteorol. Labs. Collected Reprints, 1969, Vol. 2 Sep. 1970 7 p refs Repr. from J. Geophys. Res., v. 74, no. 10, 1969 p 2590-2596 *Its* Contrib. 14 (See N71-36973 23-20)
Copyright. Avail: SOD $3.75

Field evidence is presented for the occurrence of additional waves arising from an interaction between incident shallow-water waves and submerged shoals. A given additional wave is induced by the passage of an incident wave crest over the crown and downwave flank of a bar. Induced waves were observed under conditions that commonly occur on benches with wavebuilt bars. Such waves may significantly influence nearshore processes. Author

N71-36992# Atlantic Oceanographic and Meteorological Labs., Miami, Fla.
PELAGIC TIDAL MEASUREMENTS c13
David Cartwright (Natl. Inst. of Oceanog., Engl.), Walter Munk (Calif. Univ., La Jolla), and Bernard D. Zetler *In its* Collected Reprints, 1969, vol. 2 Sep. 1970 8 p refs Repr. from Trans. Amer. Geophys. Union, v. 50, no. 7 p 472-477 (See N71-36973 23-20)
Avail: SOD $3.75

An analysis program designed for pelagic observations is described. The method is suitable for the analysis of tidal disturbances in any geophysical measurements in exposed areas where it is possible to take advantage of data from related, long-established reference stations. The proposed programs employs the response method of tidal analysis. E.M.C.

N71-36993# Environmental Science Services Administration, Honolulu, Hawaii.
BRIGHTNESS VARIATIONS OF THE WHITE LIGHT CORONA DURING THE YEARS 1964 - 1967 c13
Richard T. Hansen (High Altitude Obs., Kamuela, Hawaii), Charles J. Garcia (High Altitude Obs., Kamuela, Hawaii), Shirley F. Hansen (High Altitude Obs., Kamuela, Hawaii), and Harold G. Loomis *In* Atlantic Oceanog. and Meteorol. Labs. Collected Reprints, 1969, vol. 2 Sep. 1970 17 p refs Repr. from Solar Phys. (Netherlands), v. 7, 1969 p 417-433 (See N71-36973 23-20)

Copyright. Avail: SOD $3.75

Observations of the white light corona were made on over 900 days during the years 1964-67 at heights between 1.125 and 2.0 solar radii with the K-coronameter at Mount Haleakala and Mauna Loa, Hawaii. The brightness distribution of the minimum corona was elliptical with average equatorial intensities three times the polar. Coronal features of the new cycle at 1.125 solar radii occurred predominantly in the sunspot zones at 25-30 deg latitude and in a high latitude zone which migrated toward the North pole before solar maximum. The brightness of the inner corona doubled over this period and a close association is found between the average corona and 10.7-cm solar radio flux. Electron densities in the equatorial regions were nearly twice those of Van de Hulst's model corona, in agreement with the results of recent eclipse observations. Author

N71-36994# Environmental Science Services Administration, Honolulu, Hawaii.
DIFFERENTIAL ROTATION OF THE SOLAR ELECTRON CORONA c29
Richard T. Hansen (High Altitude Obs., Kamuela, Hawaii), Shirley F. Hansen (High Altitude Obs., Kamuela, Hawaii), and Harold G. Loomis *In* Atlantic Oceanog. and Meteorol. Labs. Collected Reprints, 1969, vol. 2 Sep. 1970 15 p refs Repr. from Solar Phys. (Netherlands), v. 10, 1969 p 135-149 (See N71-36973 23-20)
Copyright. Avail: SOD $3.75

Autocorrelation analyses of K-coronameter observations made at Haleakala and Mauna Loa, Hawaii have established average yearly rotation rates of coronal features as a function of latitude and height above the limb. At low latitudes the corona was found to rotate at the same rate as sunspots but at higher latitudes was consistently faster than the underlying photosphere. There were differences as large as 3-4% in the rate at specific latitudes from year to year and between the two hemispheres. In 1967 a nearly constant rotation was found for heights ranging from 1.125 to 2.0 R sub zero. For 1966 there was a more complicated pattern of height dependence, with the rate generally decreasing with height at low latitudes and increasing at high latitudes. Author

N71-36995# Pacific Oceanographic Lab., Seattle, Wash.
ANOMALOUS TEMPERATURE OF BOTTOM WATER IN THE PANAMA BASIN c13
Norman P. Laird *In* Atlantic Oceanog. and Meteorol. Labs. Collected Reprints, 1969, vol. 2 Sep. 1970 3 p refs Repr. from J. Mar. Res., v. 27, no. 3, 1969 p 355-357 (See N71-36973 23-20)
Avail: SOD $3.75

Precise temperature, salinity, and oxygen measurements are recommended to determine the mechanism responsible for temperature anomalies of bottom water in the Panama Basin. The uniformity of the salinity structure in the eastern and western parts of the basin suggests a single source of bottom water. However, studies confirm that bottom potential temperatures vary about 0.1 C; bottom water in the western part of the basin being warmer than that to the east. E.M.C.

N71-36996# Pacific Oceanographic Lab., Seattle, Wash.
BOTTOM CURRENT MEASUREMENTS IN THE TASMAN SEA c13
N. P. Laird and T. V. Ryan *In* Atlantic Oceanog. and Meteorol. Labs. Collected Reprints, 1969, vol. 2 Sep. 1970 6 p refs Repr. from J. Geophys. Res., v. 74, no. 23, 1969 p 5433-5438 (See N71-36973 23-20)
Copyright. Avail: SOD $3.75

Bottom current velocities of 1 to 9 cm/sec were measured for periods of 0.5 to 1.2 hours at five sites in the Tasman Sea. At four sites a northerly component was present. Bottom photographs indicate stronger currents have occurred at several sites. The results in most cases support previous ideas on flow inferred from water properties. Author

N71-36997# Environmental Science Services Administration, Honolulu, Hawaii.
LONG WAVES ALONG A SINGLE-STEP TOPOGRAPHY IN A SEMI-INFINITE UNIFORMLY ROTATING OCEAN c13
J. C. Larsen *In* Atlantic Oceanog. and Meteorol. Labs. Collected Reprints, 1969, vol. 2 Sep. 1970 5 p refs Repr. from J. Mar. Res., v. 27, no. 1, 1968 p 1-6 (See N71-36973 23-20)
Avail: SOD $3.75

The dispersion equation for Kelvin-type waves for a single-step topography is derived. Solutions for this equation indicate that, in addition to the Kelvin-type waves, there also exist quasigeostrophic waves that are related to the topography structure. Author

N71-36998# California Univ., La Jolla. Scripps Inst. of Oceanography.
HEAT TRANSFER IN THE TOP MILLIMETER OF THE OCEAN c13
E. D. McAlister and William McLeish *In* Atlantic Oceanog. and Meteorol. Labs. Collected Reprints, 1969, vol. 2 Sep. 1970 7 p refs Repr. from J. Geophys. Res., v. 74, no. 13, 1969 p 3408-3414 (See N71-36973 23-20)
Copyright. Avail: SOD $3.75

Different mechanisms of heat transfer to the ocean surface dominate within different depth regions. Under suitable weather conditions, radiation dominates within the upper micron of depth. Turbulence is dominant at greater depths, but the evidence indicates that, with wind speeds less than 10 m/sec, it dominates only at depths greater than 0.5 mm. A region in which heat is transferred almost entirely by conduction lies between. Radiometric measurements of the total heat flow to the ocean surface may be made in this region. Author

N71-36999# Environmental Science Services Administration, Washington, D.C.
THE POTENTIAL APPLICATION OF REMOTE SENSING TO SELECTED OCEAN CIRCULATION PROBLEMS c13
Raymond M. Nelson *In* Atlantic Oceanog. and Meteorol. Labs. Collected Reprints, 1969, vol. 2 Sep. 1970 8 p refs Repr. from Oceans from Space, p 38-46 (See N71-36973 23-20)
Avail: SOD $3.75

In addition to aerial photography and airborne infrared radiation devices, remote sensing is being explored for its potential application to selected ocean circulation problems. E.M.C.

N71-37000# Atlantic Oceanographic and Meteorological Labs., Miami, Fla. Sea Air Interaction Lab.
A FOURTH BRINE HOLE IN THE RED SEA? c13
Feodor Ostapoff *In its* Collected Reprints, 1969, vol. 2 Sep. 1970 4 p refs Repr. from Hot Brines and Recent Heavy Metal Deposits in the Red Sea, p 18-21 (See N71-36973 23-20)
Avail: SOD $3.75

Some of the results of the Oceanographer (USC & GS) crossing of the Red Sea are discussed. Another hot hole was observed 617-Km north-northwest of the original hot brine area. Three reflecting layers were observed in the Atlantis 2 Deep that are apparently related to the different brine layers. Author

N71-37001# Pacific Oceanographic Lab., Seattle, Wash.
DEEP WATER PROPERTIES AND FLOW IN THE CENTRAL NORTH PACIFIC c13
R. K. Reed *In* Atlantic Oceanog. and Meteorol. Labs. Collected Reprints, 1969, vol. 2 Sep. 1970 9 p refs Repr. from J. Mar. Res., v. 27, no. 1, 1968 p 24-31 (See N71-36973 23-20)
Avail: SOD $3.75

Values of potential temperature, salinity, and dissolved oxygen at deep levels in the central North Pacific are presented and discussed, and the direction of flow is inferred. Deep water from the south appears to spread into the northern region by way of a western route rather than directly through the central region. Author

N71-37002# State Univ. of New York at Buffalo. Div. of Interdisciplinary Studies and Research.
DIFFRACTION OF A PLANE ACOUSTIC PULSE BY A FREE ORTHOGONAL TRIHEDRON (THREE-DIMENSIONAL CORNER) c12
Richard P. Shaw and Daniel F. Courtine *In* Atlantic Oceanog. and Meteorol. Labs. Collected Reprints, 1969, vol. 2 Sep. 1970 3 p Repr. from J. Acoust. Soc. Amer., v. 46, no. 5, 1969 p 1382-1384 Sponsored in part by ONR (See N71-36973 23-20)
Avail: SOD $3.75

The normal velocity field on arbitrary three-dimensional scattering surfaces struck by a weak acoustic plane wave, is considered. A numerical solution for a right-angle corner (i.e., three orthogonal edges of infinite length) is found for a step-incident pressure wave, while the wavefront normal is taken to form equal angles with the three orthogonal edges. The scattering obstacle is assumed to have a free surface (i.e., pressure is zero). Author

N71-37003# State Univ. of New York at Buffalo. Div. of Interdisciplinary Studies and Research.
TRANSMISSION OF PLANE WAVES THROUGH LAYERED LINEAR VISCOELASTIC MEDIA c12
R. P. Shaw and P. Bugl *In* Atlantic Oceanog. and Meteorol. Labs. Collected Reprints, 1969, vol 2 Sep. 1970 6 p refs Repr. from J. Acoust. Soc. Amer., v. 46, no. 3, 1969 p 649-654 Sponsored in part by ONR (See N71-36973 23-20)
Avail: SOD $3.75

The two-dimensional propagation of time-harmonic plane waves through a plane horizontally layered viscoelastic medium is discussed. The problem is formulated as the equivalent elastic plane-strain case with modified Lame constants, which are complex and frequency dependent, replacing the usual elastic Lame constants. Rather than use potentials, incident angles, etc., we formulate the problem directly in terms of stresses and displacements and solve it by using matrix methods. This approach is felt to be more direct and leads to some interesting conclusions. If the incident wave is not attenuated in the direction parallel to the layering, interface waves can be generated only if one of the layers is pseudoelastic, i.e., has at least one real wave speed. In this case, the interface waves are generated in the same manner as in the purely elastic case. Such a physical problem would exist, for example, if the incident waves were to travel through a semi-infinite elastic half-space before striking the plane viscoelastic layers. If the incident wave is attenuated in the direction parallel to the layering, interface waves can be generated at specific angles of incidence and specific combinations of material parameters. Author

N71-37004# Environmental Science Services Administration, Honolulu, Hawaii.
ADIABATIC ELASTIC MODULI OF VITREOUS CALCIUM ALUMINATES TO 3.5 KILOBARS
T. J. Sokolowski and M. H. Manghnani (Hawaii Univ., Honolulu) *In* Atlantic Oceanog. and Meteorol. Labs. Collected Reprints, 1969, vol. 2 Sep. 1970 4 p refs Repr. from J. Amer. Ceram. Soc., v. 52, no. 10, p 539-542 (See N71-36973 23-20)
Avail: SOD $3.75

Pulse superposition (ultrasonic interferometry) was used to measure elastic wave velocities and related elastic parameters of four vitreous calcium aluminate specimens at pressures up to 3.5 kbars at 25 C. The values obtained for the bulk and shear moduli and for Poisson's ratio were much higher than those reported for silicate glasses. The bulk moduli for the calcium aluminates, however, fit quite well with the relation between bulk modulus and specific volume per ion pair suggested for 29 glasses. The BaO doping seemed to cause anomalous behavior in the shear wave velocity vs pressure relation. The differences in the compressibility at 1 bar and the rate of change of compressibility at 1 bar and the rate of change of compressibility with pressure appear to be related to composition and melt conditions. Author

N71-37006# Atlantic Oceanographic and Meteorological Labs., Miami, Fla. Physical Oceanography Lab.
TIDAL MODULATION OF THE FLORIDA CURRENT SURFACE FLOW c13
John A. Smith (Miami Univ., Fla.), Bernard D. Zetler, and Saul Broida (Miami Univ., Fla.) *In its* Collected Reprints, 1969, vol. 2 Sep. 1970 6 p refs Repr. from J. Mar. Technol. Soc., vol. 3, no. 3, May 1969 p 41-46 (See N71-36973 23-20)
(Contract Nonr-4008(02))
Avail: SOD $3.75

A tidal current analysis has been made of surface current observations obtained in 1965 in the Florida current off Hollywood, Florida. The analysis of 15 days of hourly speeds shows that the diurnal constituents have larger amplitudes than the semidaily, this is in sharp contrast to the predominantly semidaily tide in the area. The amplitudes and phases of the diurnal constituents support the hypothesis of a diurnal standing wave oscillating between the open ocean and the Gulf of Mexico with a node in the Florida Straits near the latitude of Miami. The tidal analysis indicates that the tidal modulation accounts for roughly one fifth of the variance in the observations. Author

N71-37006# Atlantic Oceanographic and Meteorological Labs., Miami, Fla. Physical Oceanography Lab.
FLUCTUATIONS OF THE FLORIDA CURRENT INFERRED FROM SEA LEVEL RECORDS c13
C. Wunsch (MIT), D. V. Hansen, and B. D. Zetler *In its* Collected Reprints, 1969, vol. 2 Sep. 1970 24 p refs Repr. from Deep-Sea Res.(England), v. 16, 1969 p 447-470 (See N71-36973 23-20)
(Grant NSF GA-434)
Avail: SOD $3.75

Power spectra and coherences were computed from simultaneous tide records at Miami, Florida; Cat Cay, Bimini Islands; Key West, Florida; and Havana, Cuba, as a measure of statistical variability of the Florida current. Diurnal and semi-diurnal tides account for most of the power in sea level variations at all stations, and approximately half of the remaining power is in the annual variation. Power levels are generally higher on the left side of the current but no significant power peaks were found between the annual and tidal frequencies. Coherence is generally low between all stations, but where significant coherence is found, it occurs with essentially zero phase, indicating that sea level tends to rise or fall together on opposite sides of the Florida Straits. The zero-phase coherence suggests a common response to local weather events. Low coherence was found between atmospheric pressure and sea level, with essentially an inverted barometer response for fluctuations of period greater than ten days. A sharp result is obscured by the general lack of coherence between records, but the major conclusions are that the Florida current is fairly steady, rms. modulation at all periods between two days and one year amounting to perhaps 25% of the mean, the annual fluctuations accounting for about 10%, and linear weather effects have only a minor influence on statistical sea level. Author

N71-37007# Atlantic Oceanographic and Meteorological Labs., Miami, Fla.
TIDES c13
B. D. Zetler *In its* Collected Reprints, 1969, vol. 2 Sep. 1970 14 p refs Repr. from Handbook of Ocean and Underwater Engineering, North American Rockwell, Inc. (See N71-36973 23-20)
Avail: SOD $3.75

A simple model is formulated which permits a useful delineation of the forces involved in tidal theory. If a rigid earth is considered to be completely covered by a deep layer of ocean, the magnitude and direction of the tidal forces can be related to the various motions of the moon and sun. Friction and inertia are disregarded, so it is assumed that the water responds instantly to the attraction of the tide-producing body. Author

N71-37008# Atlantic Oceanographic and Meteorological Labs., Miami, Fla. Physical Oceanography Lab.
COMPUTER APPLICATIONS TO TIDE AND CURRENT ANALYSIS IN THE COAST AND GEODETIC SURVEY c13
Bernard D. Zetler *In its* Collected Reprints, 1969, vol. 2 Sep. 1970 3 p refs Repr. from Proc. of the Symp. on Tides, Monaco, 1967 (See N71-36973 23-20)
Avail: SOD $3.75

Problems associated with developing computer programs for the data reduction associated with tide and ocean currents are examined. The major problem is in deciding on a method of choosing times of high and low waters. Several options are proposed, and an evaluation of the least squares approach was made with 12 consecutive 29 day series, using the results from the year as the criteria for accuracy, but the results were not significantly better than comparable analyses made by traditional methods. E.M.C.

N71-37009# Atlantic Oceanographic and Meteorological Labs., Miami, Fla.
SHALLOW-WATER TIDE PREDICTIONS c13
Bernard D. Zetler *In its* Collected Reprints, 1969, vol. 2 Sep. 1970 4 p refs Repr. from Proc. of the Symp. on Tides, Monaco, 1967 (See N71-36973 23-20)
Avail: SOD $3.75

A harmonic method of predicting shallow-water tides is described which identifies significant hidden frequencies. The method was devised to improve predictions at Anchorage, Alaska, where the tidal range is about eight meters and the routine tide predictions were not sufficiently accurate for the navigation needs of deep-draft oil tankers. Inasmuch as the port freezes during the winter, the available length of record was 192 days of hourly heights. A standard U.S. Coast and Geodetic Survey analysis of the data, a prediction for the same period that is subtracted from the data, a power spectrum analysis of the residuals, and a high resolution Fourier analysis of the frequency bands in which the spectral energy is high are detailed. Wherever large values stood out above the continuum in a plot of the Fourier amplitudes, an effort was made to identify an integral contination of frequencies of constituents known to be important that closely matched the frequencies of these peaks. The resulting predictions (with 114 constituents) matched the observed high and low waters better in times and mean range, the difference between the tide level and sea level was better, and the residual variance (using hourly heights) was sharply reduced. Author

N71-37010# Atlantic Oceanographic and Meteorological Labs., Miami, Fla.
TIDE TALK c13
Bernard D. Zetler *In its* Collected Reprints, 1969, vol. 2 Sep. 1970 6 p Repr. from Go Boating, Miami, Jan. - Oct. 1969 (See N71-36973 23-20)
Avail: SOD $3.75

A brief history of tide predictions is given with emphasis on nautical almanacs, geodetic surveys, and related applications. Tides are classified in three categories: semidaily, mixed, and daily. The aid of the computer in tide prediction data reductions is emphasized, and it is suggested that sea level is constantly rising. E.M.C.

N71-37011# National Weather Service, Silver Spring, Md.
NUMERICAL WEATHER PREDICTION ACTIVITIES, NATIONAL METEOROLOGICAL CENTER, FIRST HALF 1971
Aug. 1971 41 p
Avail: NTIS

The activities of the meteorological center for numerical weather forecasting are reported. The efforts discussed include: (1) the refinement of an eight-layer primitive equation (PE) model, (2) use of a hemispheric three-dimensional analysis program to construct initial conditions for testing the PE model, (3) performance evaluation of a limited-area fine-mesh forecasting model, (4) tests conducted in the air pollution potential forecast program, (5) use of PE model output to forecast precipitation, (6) experiments with a thermodynamic model for long-range numerical weather and ocean temperature predictions, and (7) changes made in the information processing system. D.L.G.

N71-37012# Institut Royal Meteorologique de Belgique, Brussels.
ATMOSPHERIC POLLUTION, SMOKE AND SULFUR DIOXIDE Monthly Bulletin, Dec. 1970 [POLLUTION ATMOSPHERIQUE, FUMEE ET ANHYDRIDE SULFUREUX BULLETIN MENSUEL, DECEMBRE 1970]
1970 28 p In FRENCH and DUTCH Prepared jointly with Inst. d'Hyg. et d'Epidemiol.
Avail: NTIS

Data obtained at Belgian weather stations in December 1970 is tabulated. The air pollution apparatus is briefly described. ESRO

N71-37013# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
HUNTER-LIGGETT MILITARY RESERVATION, CALIFORNIA: MILPITAS, ALPHA, IRUS, JOLON, SAM JONES Meteorological Data Report
Dec. 1970 109 p
(AD-726938) Avail: NTIS CSCL 04/2

The report contains the following meteorological data collected at sites within the Hunter-Liggett military reservation during December 1970: atmospheric precipitation; atmospheric pressure; atmospheric temperature; humidity; wind. GRA

N71-37014# Army Electronics Command, Fort Huachuca, Ariz. Atmospheric Sciences Lab.
MICROMETEOROLOGICAL FIELD DATA FROM DAVIS, CALIFORNIA: 1966 - 1967 RUNS UNDER NON-ADVECTION CONDITIONS
Ernest B. Stenmark and Lome D. Drury Aug. 1970 628 p refs (AD-726390; ECOM-6051) Avail: NTIS CSCL 04/2

Micrometeorological data acquired during non-advection conditions in 1966 and 1967 at the University of California, Davis, field site are presented as 30-minute mean quantities in tabular form. Energy balance components and temperature and wind profiles are given in both tabular and plotted forms. Author (GRA)

N71-37015# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PRACTICAL METHODS IN NUMERICAL WEATHER FORECASTING
P. N. Belov 31 Mar. 1971 414 p refs Transl. into ENGLISH from "prakticheskie metody chislennogo prognoza pogody" Leningrad, Izd-vo Gidrometeorologicheskoye, 1967 p 1-335 (AD-726587; FTD-HC-23-561-70) Avail: NTIS CSCL 04/2

The book is concerned with the fundamentals of the up-to-date theory of hydrodynamic weather forecasting. Particular regard is paid to non-geostrophic methods of forecasting which are used in practical forecasting service work. Numerical analysis of meteorological information and methods of physical statistics as used in weather forecasting are discussed. Author (GRA)

N71-37016# Istituto di Fisica Dell Atmosfera, Rome (Italy).
MEASURING IONIZATION OF AIR IN DIFFERENT METEOROLOGICAL AND AMBIENT CONDITIONS [MISURE DI IONIZZAZIONE DELL'ARIA IN DIFFERENTI CONDIZIONI METEOROLOGICHE E AMBIENTALI]
R. Ferrara and G. Tonna 1970 11 p refs In ITALIAN; ENGLISH summary Presented at the 18th Conf. of the Assoc. Geofis. Ital., Naples, 1-4 Oct. 1969
(IFA-CP-226) Avail: NTIS

A series of small ion concentration measurements taken under different meteorological and environmental conditions, including open country, polluted sites, artificially conditioned sites, and in fog, is presented and discussed. Author

N71-37017# Istituto di Fisica Dell Atmosfera, Rome (Italy).
ATMOSPHERIC FACTORS AND HYDROLOGICAL CONSEQUENCES (SNOW MELTING) [FATTORI ATMOSFERICI E CONSEGUENZE IDROLOGICHE (FUSIONE DELLA NEVE)]
S. Palmieri 1971 16 p refs In ITALIAN; ENGLISH summary Presented at the 18th Conf. of the Assoc. Geofis. Ital., Naples, 1-4 Oct. 1969 Submitted for publication
(IFA-CP-232) Avail: NTIS

The geographical and geological features of Place Moulin (Northwestern Alps) and the factors that affect snow-melt are described. A comparison between the actual and computed values of melt is presented, and the results are discussed taking into account the synoptic meteorological features associated with the maxima and minima of melt. The possibility of forecasting snow-melt is also considered. Author

N71-37018# Texas Univ., Austin. Atmospheric Science Group.
TURBULENT FLUXES AND ASSOCIATED SPECTRA IN A SEA BREEZE BOUNDARY LAYER
Louis A. Hembree, Jr. Aug. 1971 100 p refs
(Grants NSF GA-367X1)
(Rept-29) Avail: NTIS

During three days in July 1968, wind and temperature fluctuation data were taken for the calculation of turbulent fluxes of momentum and sensible heat in a sea breeze regime. The experimental site was located on the upper Texas Gulf coast east of Galveston, Texas. The data were taken with a bivane anemometer and thermocouple mounted at a height of approximately 8 meters on a tower located 90 meters inland from the shore. The eddy-correlation technique was used to calculate the turbulent fluxes of sensible heat and momentum. In addition, a spectral analysis was performed on the data. Author

N71-37019# Naval Weather Service Command, Washington, D.C.
SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS. HAWAIIAN AND SELECTED NORTH PACIFIC ISLAND COASTAL MARINE AERAS. VOLUME 4: AREA 11 - PONAPE, AREA 12 - TRUK, AREA 13 - PAGAN
Jun. 1971 483 p
(AD-726740) Avail: NTIS CSCL 04/2

The data contained in these tables were obtained from tape data Family 11 (TDF-11), Marine Surface observations. TDF-11 was primarily funded by the Naval Weather Service Command and selected by NWSED Asheville as the most comprehensive collection of marine surface observations from which to develop a series of coastal marine summaries. The areas discussed in this report include Ponape, Truk and Pagan. GRA

N71-37020# Drexel Univ., Philadelphia, Pa. Dept. of Physics.
DIAGNOSTIC STUDIES OF SUBSYNOPTIC ATMOSPHERIC STRUCTURE
Sumner Barr, Paul E. Long, and Irvin A. Miller Sep. 1970 74 p refs
(Contract F19628-69-C-0092)
(AD-726628; AFCRL-70-0617; SR-2) Avail: NTIS CSCL 04/2

A fine mesh diagnostic vertical velocity model is presented and compared with cloudiness observed from surface satellite observations in order to document some properties of subsynoptic atmospheric variations. The model proves to be useful as a tool for studies on this scale as indicated by the validation against observed data and independent model prepared by Krishnamurti. Application of the model to a series of case studies reveals some aspects of the interactions between subsynoptic and larger synoptic scale motion systems and their characteristic cloud patterns. Author

N71-37021# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
A NUMERICAL STUDY OF THE DEVELOPMENT OF FRONTAL MOTIONS
Dasiraju S. Rao and J. Michael Fritsch Jan. 1971 41 p refs /ts paper No. 171
(Contract F19628-68-C-0104)
(AD-726617; AFCRL-71-0320; SR-4) Avail: NTIS CSCL 04/2

Development of frontal disturbances is considered from a non-linear initial value point of view. The frontal model is a two layer model with a wedge of cold air to the north represented by a homogeneous fluid layer of density rho sub 1, and an overlying warm air layer represented by another homogeneous fluid of density rho sub 2(+ rho sub 1). The warm and cold air layers have finite depths and the region of integration is bounded in the north-south direction by rigid boundaries. Inside this region, the depth of cold air goes to zero at some point, depicting the intersection of the frontal surface with the ground. The point of intersection essentially represents a free boundary. The west-east boundaries are periodic. A sinusoidal disturbance is imposed on the frontal surface and the growth of this disturbance is calculated numerically for two different initial conditions. For each set of initial conditions, various wave lengths and initial shears are considered. The frontal surface at each time step is determined by a simple linear extrapolation of the cold air height fields from the north. Author (GRA)

N71-37022# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
RESEARCH ON OBJECTIVE ANALYSIS AND DENSITY DISCONTINUITIES Final Report, 11 Oct. 1967 - 31 Aug. 1970
Ferdinand Baer, J. Michael Fritsch, and Dasiraju S. Rao Dec. 1970 21 p refs
(Contract F19628-68-C-0104)
(AD-726619; AFCRL-71-0321) Avail: NTIS CSCL 04/2

The following studies were conducted during 1967 - 1970 as part of a contract on weather forecast procedures: application of cubic spline technique to two-dimensional data fields for the purposes of objective analysis; an investigation into the mechanics of frontal instability under idealized conditions; an experiment to numerically simulate the characteristics of frontal development from a non-linear initial value point of view. A program was set up to integrate the primitive equations for precipitation forecasts on synoptic scales. This part of the investigation, however, did not proceed beyond the formulation stage of the basic model due to shortage of funds and time. Author (GRA)

N71-37033# Bureau of Meteorology, Sydney (Australia).
FREQUENCIES, TRACKS AND INTENSITIES OF TROPICAL CYCLONES IN THE AUSTRALIAN REGION NOVEMBER 1909 - JUNE 1969
F. Coleman Jul. 1971 104 p refs
Avail: NTIS

Monthly frequencies of cyclones for the season November to June are tabulated. Maps of tracks and average frequency of cyclones crossing 5-degree latitude-longitude squares per 10 years for December to April are presented. The frequency of centers endangering the coast and passing within 30, 60, and 90 nautical miles of places named are tabulated. Frequency distributions, directions, and speed of movement of cyclones along their tracks are presented. Author

N71-37034# Sandia Labs., Albuquerque, N.Mex.
LIGHTNING AND BALL LIGHTNING: FRONTIERS FOR RESEARCH
J. A. Cooper 10 May 1971 17 p Sponsored by AEC
(SC-DC-713998) Avail: NTIS

Interest in lightning and ball lightning has increased dramatically. Information about these phenomena affects or might affect various scientific areas including safety, weapons strategy, magnetohydrodynamics, and meteorology. Studies of

lightning and ball lightning are made difficult by the relative rarity and unpredictable locations of the events. However, there is a strong possibility that triggering mechanisms might be employed in making these phenomena more accessible to researchers. Author (NSA)

N71-37025# Bureau of Meteorology, Sydney (Australia).
MONTHLY CLIMATE DATA-SURFACE, AUSTRALIA, MARCH 1971
Mar. 1971 56 p refs
Avail: NTIS

Climatological statistics most likely to meet the need of commerce, education, primary and secondary industry, researvh and other fields are tabulated. The mean monthly data include pressure, cloud, temperature, sunshine, rain, evaporation, and wind measurements for each district. Author

N71-37026# National Weather Service, Fort Worth, Tex. Scientific Services Div.
A STUDY OF FUNNEL CLOUD OCCURRENCES IN THE BEAUMONT-PORT ARTHUR-ORANGE AREA IN TEXAS
Carlos Garza, Jr. Jan. 1971 12 p refs
(NOAA-TM-NWS-SR-52) Avail: NTIS

Statistical information on funnels aloft in the Beaumont-Port Arthur-Orange, Texas area was gathered for the 20 year period from 1950 to 1969. The majority of the funnel cloud activity was found to occur during the late spring, summer, and early autumn months with the peak occuring during July. Most funnels occurred during the day and 83% never touched ground. Synoptic conditions were examined and a general rule of thumb stated for funnel cloud study in the Port Arthur area. Author

N71-37027# Rosenstiel School of Marine and Atmospheric Sciences, Miami, Fla.
CLOUD PHYSICS RESEARCH Final Report, 1 Sep. 1970 - 31 Aug. 1971
H. V. Senn and C. L. Courtright 31 Aug. 1971 25 p refs
(Contract NOAA-E-62-71(N))
(ML-71069) Avail: NTIS

A description of the radar data gathering facilities and activities in support of the 1971 NOAA Experimental Meteorological Laboratory cumulus seeding experiments is given. An attempt was made to gather special data which might be used in studying the relationship between pulse-to-pulse signal characteristics and drop-size information gained from a new ground-based disdrometer as well as from foil samplers aboard an aircraft at cloud base. Finally, methods are outlined which would improve the quality of the data for several studies and an outline is presented of research under way to quantize cloud growth rates obtained from 1971 radar data. Author

N71-37028 National Lending Library for Science and Technology, Boston Spa (England).
ON THE FREQUENCIES OF SOME TYPES OF MACRO PROCESSES AND THE POSSIBILITY OF FORECASTING THEM
Z. L. Turketti 13 Apr. 1971 24 p refs Transl. into ENGLISH from Tr. Tsentral. Inst. Prognozov (Moscow), no. 154, 1966 p 101-115
(NLL-M-20441-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

An objective assessment is made of the frequency of various types of macroprocesses with three- and five-monthly rhythms. A number of practically useful rules are obtained for the recurrence of the initial forms and state of the circulation. These are also established objectively by means of circulation indices. Author

N71-37029 National Lending Library for Science and Technology, Boston Spa (England).
PERSISTENCE OF DEGREE OF ANOMALY OF FIELDS OF METEOROLOGICAL ELEMENTS
M. G. Ter-Mkrtcjan [1970] 10 p refs Transl. into ENGLISH from Tr. Nauch.-Issled. Cent. SSSR, Gidromet. (Leningrad), no. 63, 1970 p 57-66
(NLL-M-20652-(5828.4F)) Avail: Natl. Lending Library, Boston Spa Engl.: 1 NLL photocopy coupon

A numerical analysis of the persistence of degree of anomaly of fields of meteorological elements is presented. The degree of anomaly of the field can be judged from the index of anomaly of a field. The index is actually the standardized coefficient of scatter of a sample about a zero mean. The distribution of the index was investigated. On the assumption that the dimensional anomaly vector is normal, it is shown that the index has a generalized gamma distribution. Author

N71-37030 National Lending Library for Science and Technology, Boston Spa (England).
DEVELOPMENT OF CALMS IN THE BOUNDARY LAYER OF THE ATMOSPHERE
B. I. Vdovin et al 13 Apr. 1971 7 p refs Transl. into ENGLISH from Tr. Glav. Geofiz. Obs. (Leningrad), no. 238, 1969 p 191-194
(NLL-M-20442-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The development of calms of varying intensity was studied using measurements between 8 and 232 m on the Leningrad and Novosibirsk TV masts, and on a high meteorological mast in Obninsk. The observations were made over a period of two years at the TV masts and four years at the meteorological mast. The frequency of calms was found to vary inversely as the intensity. The frequency of intense calms up to 100 m had a diurnal variation, with maximum in the morning hours. Most of the calms were associated with isothermal conditions or inversion in the calm layer. A maximum number of calms was noted in December - January. N.E.N.

N71-37031 National Lending Library for Science and Technology, Boston Spa (England).
PROBLEMS AND POSSIBILITIES OF MATHEMATICAL-METEOROLOGICAL DIFFUSION MODELS PERTAINING TO AIR POLLUTION
H. Fortak 2 Mar. 1971 18 p refs Transl. into ENGLISH from Freie Univ. Inst. Met. (Berlin), 1968
(NLL-M-20362-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Mathematical-meteorological diffusion models for solutions of urban pollution problems are discussed. Problems involving short-range forecasts of ground-level fall-out concentrations, computations of statistical air pollution characteristics, and estimates of minimum chimney stack heights are examined. Examples of statistical urban fall-out characteristics are presented. These are based on a full register of sources and frequency distributions of relevant meteorological factors. Author

N71-37032 National Lending Library for Science and Technology, Boston Spa (England).
LASER-METEOROLOGIST
V. Zuyev 13 Apr. 1971 5 p Transl. into ENGLISH from Pravda (Moscow), 20 Oct. 1970
(NLL-M-20428-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The capabilities and limitations of present meteorological probes are summarized, and the possibilities of using lasers for weather forecasting are discussed. The characteristics of ruby lasers are described, along with measurements they can make such as wind velocity, molecular concentration, Aurora Borealis dynamics, cloud thickness, cloud particle dimension and concentration, aerosol layers, and silvery cloud thickness. N.E.N.

N71-37033+ Danish Meteorological Inst., Charlottenlund.
MONTHLY SURFACE TEMPERATURES OF THE NORTHERN ATLANTIC, 50-60 DEG N, 0-60 DEG W, 1969

[MANDELIGE OVERFLADETEMPERATURER I DET NORDLIGE ATLANTERHAV, 50-80 DEG N, 0-60 DEG W]
1971 27 p In DANISH and ENGLISH
(ISBN-87-7478-036-0) Avail: NTIS

Monthly sea surface temperature measurements of the Northern Atlantic are given in meteorological charts. The measurements were made from Danish ships and cover the area 50 to 80 deg N and 0 to 60 deg W for each 1 deg square. If available, the number of observations made and the average of the observations are also given. Land areas are outlined in connection with the information given. Author

N71-37034 World Meteorological Organization, Geneva (Switzerland). Joint Organizing Committee for GARP.
REPORT OF THE FIFTH SESSION OF THE JOINT ORGANIZING COMMITTEE
1971 87 p refs Conf. held at Bombay, 1-5 Feb. 1971
Prepared jointly with ICSU
Avail: Issuing Activity

The topics covered are a summary present and planned activities of the numerical experimentation program, the status and objectives of the GARP Atlantic tropical experiment (GATE), the observations of the Global experiment, and organization of future work. Author (ESRO)

N71-37035 World Meteorological Organization, Geneva (Switzerland).
THE PRESENT STATUS OF CONSTANT-LEVEL BALLOON PROGRAMMES
1971 91 p refs *Its* World Weather Watch Planning Rept. 33 (WMO-295) Copyright. Avail: Issuing Activity

The purpose of constant-level balloons, the most common types used in meteorology, and the history of the balloon concept, are outlined. This leads to a description of the global horizontal sounding technique program in the Southern Hemisphere. Three projects associated with the GHOST program are discussed: (1) the Nimbus 4/interrogation, recording, and locating system which makes use of a satellite to track stratospheric constant-level balloons over the equator; (2) the tropical wind, energy conversion, and reference level experiment, planned for 1974 with a satellite locating and relaying data from 300 constant-level balloons in the upper troposphere equatorial zone and the Southern Hemisphere; and (3) the carrier balloon dropsonde system which supplements upper air observations made by other methods in data sparse areas of the tropic and Southern Hemisphere. A detailed description is given of the EOLE program, which locates and relays data from up to 500 constant-level balloons in the upper troposphere over the Southern Hemisphere. An operational constant-level balloon experiment in the Southern Hemisphere is outlined, followed by a discussion of the way in which constant-level balloons may be incorporated in the observing system for the first GARP global experiment, and their possible contribution to the world weather watch global observing system. Author (ESRO)

N71-37036 World Meteorological Organization, Geneva (Switzerland). Joint Organizing Committee for GARP.
THE GLOBAL ATMOSPHERIC RESEARCH PROGRAMME: A COOPERATIVE EFFORT TO EXPLORE THE WEATHER AND CLIMATE OF OUR PLANET
Bert Bolin 1971 31 p Prepared jointly with ICSU
Copyright. Avail: Issuing Activity

An attempt is made to explain the aims of the global atmospheric research program (GARP) in terms which will be understandable to a nonspecialist audience. Among the items treated are global cooperation in the field of meteorology, modelling the atmosphere, tropical problems, and the use of satellites and balloons. ESRO

N71-37037 Stanford Univ., Calif.
HYDROLOGIC EFFECTS OF PRECIPITATION AUGMENTATION
Alan Mark Lumb (Ph.D. Thesis) 1970 124 p
Avail: Univ. Microfilms Order No. 70-18434

Mathematical models for the digital computer were used to simulate rainfall augmentation and the hydrologic response of a watershed. A statistical model was developed to simulate per cent increases in hourly precipitation. A watershed model was then used to calculate the streamflow, soil moisture, and evapotranspiration. Calculations using measured precipitation with and without an assumed 10% increase were made for three watersheds. For watersheds with annual streamflow greater than 50% of the annual precipitation, over ninety per cent of the added precipitation becomes runoff and less than 10% is evaporated. For a drier watershed in which only 3% of the annual rainfall becomes runoff, only one-fourth of the added rainfall becomes runoff while about three-fourths is evaporated. Soil moisture increases averaged from 0.1 inches for dry watersheds to 0.5 inches for the watersheds in wetter climates. Increases in the mean of the annual series of peak flows ranged from 8.5 to 76% and the standard deviation ranged from zero to 58%. Dissert. Abstr.

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N71-37038# National Aviation Facilities Experimental Center, Atlantic City, N.J.
MEASUREMENT AND ANALYSIS OF EN ROUTE ATC DIGITAL RADAR SYSTEM ERRORS. Interim Report, Jul. 1970 - Mar. 1971
Clifford Chapman Sep. 1971 27 p refs
(FAA-NA-71-16) Avail: NTIS

Prior to the conduct of tests pertinent to radar separation standards, a review of previous efforts was accomplished to ascertain the application of existing data towards the establishment of separation criteria within the en route Air Traffic Control National Airspace System, Model 1 complex at Jacksonville, Florida. Data analyses and presentation were directed towards the range and azimuth resolution characteristics and aircraft separation measurement capability of the secondary radar/digitizer subsystem. Author

N71-37039# Lockheed Missiles and Space Co., Palo Alto, Calif.
INVESTIGATION OF THE PROCESS OF MAINTAINING SPACE VEHICLE ORIENTATION
V. D. Nikolaev [1971] 11 p ref Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 9, no. 3, 1971 p 381-391
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The dynamics of a pulse relay control of a solar orientation system, taking account of the probabilistic change in the characteristics of the sensors, is considered. Automatic maintenance of space vehicle orientation is characterized by constant alternation of the continuous and pulse modes of operation. A methodology for computing the probabilistic characteristics of an orientation process is developed. The accuracy and economy is estimated by means of probability distribution of the angular deviation and consumption of working body. A practical computation example is given, and the results are compared with the results of flight tests. Author

N71-37040# Institute for Telecommunication Sciences, Boulder, Colo.
LORAN A GROUNDWAVE PULSE PROPAGATION
J. R. Johler Mar. 1971 75 p refs
(OT/ITS-RR-10) Avail: SOD $0.70

The Loran A groundwave radio navigation pulse is analyzed with a computer simulation of the general pulse propagation

theory for linear amplitude systems. The natural perturbations of the propagation medium are introduced into the computer simulation and the limitations imposed by nature on the navigation system are estimated quantitatively. The propagation corrections for the radio navigator's equation are formulated so that the ultimate accuracy of the system can be estimated. The calculations show that the pulse envelope is less sensitive to propagation medium perturbations than an individual frequency component. It is concluded that the cycle to envelope discrepancy in the presence of propagation medium perturbations is sufficiently small so that cycle ambiguity in the precision cycle measurement can be resolved with the tagged point in time on the envelope. Author

N71-37041# Civil Aeromedical Inst., Oklahoma City, Okla.
ATTITUDES AND MOTIVATIONAL FACTORS IN TERMINAL AREA AIR TRAFFIC CONTROL WORK
Roger C. Smith, Bert B. Cobb, and William E. Collins Jul. 1971 30 p refs
(FAA-AM-71-30) Avail: NTIS

A sample of 614 journeymen terminal ATCSs at 17 high-density IFR airports, and 514 ATC trainees were administered a questionnaire which asked them to list what they liked best and what they liked least about ATC work in general; in addition, ATCSs made similar lists for work at their assigned facilities. Responses were surveyed for clusters, and nine response categories were established. The frequency of responses within each category was tabulated. With minor variations the pattern of responses from ATCSs was highly similar from one facility to another. The categories of job challenge, job tasks, career characteristics, and salary contained the most positive responses about ATC work, while the categories of management, work schedule, career characteristics, and job tasks had the most negative responses. Trainee attitude patterns were similar. Author

N71-37042# Lincoln Lab., Mass. Inst. of Tech., Lexington.
AN AIRBORNE TRAFFIC SITUATION DISPLAY SYSTEM
Richard W. Bush, Howard Blatt, and Francis X. Brady 29 Oct. 1971 19 p
(Contract F19628-70-C-0230)
(AD-727769; TN-1971-19; ESD-TR-71-194) Avail: NTIS CSCL 17/7

An airborne traffic situation display system which could be used as an adjunct to the evolving National Airspace System/Automatic Radar Control Terminal System (NAS/ARTS) is described. In the proposed system, a contemporary realization of an old concept, the NAS/ARTS data are broadcast. A small digital computer in an aircraft then selects from the message stream the data on its own aircraft, nearby aircraft, and a local map. These data, plus aircraft heading data from a directional gyro, are used to generate a situation display that can be aircraft-centered and heading-oriented. Author (GRA)

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N71-37043# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
UTILIZATION OF VIBRATIONAL COMPACTION FOR NUCLEAR FUEL
S. Ferrari, L. Giacquinto, and N. Petrucciani 2 Oct. 1971 29 p Presented at an Italian-Polish Meeting, Warsaw, Poland, 26 May - 6 Jun. 1970
(RT/ING-(70)22; CONF-700656-4) Avail: AEC Depository Libraries

Vibrational compaction technique in the field of nuclear energy represents an alternative to the most traditional and characteristic processes of powder metallurgy, such as pelleting and sintering. In the vibrational compaction technique great importance must be attributed to the preparation of dense material. The application of the method to some types of dense oxides is discussed. Also, an original process for the preparation of UO2, whose in-pile tests are in progress, is described. Author (NSA)

N71-37044# Oak Ridge National Lab., Tenn.
ISOTOPIC ELECTRIC GENERATORS
Francoise Lavelessiere Apr. 1971 10 p Transl. into ENGLISH from the French report CEA-Bib-190
(ORNL-TR-2485; CEA-Bib-190) Avail: AEC Depository Libraries

Technical and economic information on the achievements of several countries (USA, France, UK, Euratom, USSR, and Canada) on isotopic electricity generators are presented. Information on the radioisotope used, activity of the source, output wattage, generator lifetime, manufacturer, type of conversion used, generator weight, and primary use are given. Author (NSA)

N71-37045# European Co. for the Chemical Processing of Irradiated Fuels, Mol (Belgium).
SORPTION OF ANTIMONY BY SILICA GEL FROM NITRIC ACID AND HYDROCHLORIC ACID SOLUTIONS
H. Eschrich, M. Herrera-Huertas, and K. Tallberg Oct. 1970 23 p refs
(NP-18738; ETR-268) Avail: AEC Depository Libraries

The sorption of trace amounts of antimony-125 on silica gel from nitric acid and hydrochloric acid of various concentrations was investigated. It was found that antimony can almost quantitatively be sorbed on silica gel columns from nitric acid solutions of less than 0.5 M or higher than about 9 M. The sorption of antimony on silica gel columns from strong nitric acid solutions promotes separation of antimony selectively from fission product solutions. Antimony is strongly sorbed on silica gel columns from hydrochloric acid solutions of less than 0.5 M; the degree of sorption decreases rapidly with increasing acidity being negligibly small at hydrochloric acid concentrations higher than 6 M. Author (NSA)

N71-37046# Atomic Energy Establishment, Cairo (Egypt). Reactor and Neutron Physics Dept.
EFFECT OF NON-UNIFORM BURNUP ON REACTOR LIFETIME
O. H. Sallam, G. A. Karcheva, and I. Hamouda 1969 24 p refs
(UARAEE-83) Avail: AEC Depository Libraries

The influence of the fuel nonuniform burnup on the reactor lifetime was considered with the aid of perturbation theory. All numerical estimations were carried out in the two-group diffusion approximation for the UA-RR-1 reactor. Author (NSA)

N71-37047# Atomic Energy Establishment, Cairo (Egypt). Reactors Dept.
CRITICALITY EVALUATION OF HYDROGENEOUS ENRICHED LATTICES USING A THREE GROUP MODEL
O. H. El-Mofty, A. A. El-Demerdash, G. A. Karcheva, and M. G. Zaalouk 1969 74 p refs
(UARAEE-84) Avail: AEC Depository Libraries

A theoretical study of various reactor parameters was carried out to facilitate the design of hydrogenous reactors. The factors affecting these parameters (resonances, Dancoff correction, cut-off energy, disadvantage factor, and U-235 enrichment) were investigated. Three-group diffusion theory was used in order to attain a reasonable accuracy in which the errors in group constants may be compensated for over the energy range. Two treatments of finding diffusion coefficients for fast groups were applied. The first, for H/U-235 atomic ratios less

than 150 and the second for H/U-235 greater than 150. These constants were examined in criticality calculations for different reactors and different experiments. The comparison in both theoretical and experimental investigation shows satisfactory agreement and accuracy of about 1% for high and low enriched homogeneous and heterogeneous reactors. Author (NSA)

N71-37048# Atomic Energy Establishment, Cairo (Egypt). Reactor and Neutron Physics Dept.
SAVE: A TWO GROUP CODE FOR REFLECTOR SAVINGS OF A COMPLETELY REFLECTED CYLINDRICAL REACTOR
S. F. Nasser and M. A. Gaafar 1970 27 p refs
(UARAEE-86) Avail: AEC Depository Libraries

SAVE is a computer program code for the calculation of the reflector savings of a completely reflected cylindrical reactor in the two-group diffusion approximation. The code was designed specifically for IBM-1620. This computer has a very small capacity and an analysis of such a two-dimensional problem using a standard numerical technique is practically impossible with this device. For this reason an iterative technique was employed. The code was applied to the computation of the reflector savings of the UA-RR-1 reactor. Values of the radial and axial reflector savings were found to be 7.24 and 7.56 cm respectively. These values were found to be in a good agreement with others. Author (NSA)

N71-37049# Atomic Energy Establishment, Cairo (Egypt). Reactors Dept.
MULTIGROUP MULTIREGION CRITICALITY CALCULATION DIFFUSION CODE
H. Y. Fouad and F. H. Dimitri 1970 25 p refs
(UARAEE-90) Avail: AEC Depository Libraries

A multigroup, multiregion, one-dimensional criticality calculation diffusion code was developed for operation on the IBM 1130 computer. The code treats the three geometries, i.e., slab, cylinder, and spherical. A maximum of 18 energy groups, 4 regions, and 101 space points can be handled. Author (NSA)

N71-37050# Atomic Energy Establishment, Cairo (Egypt). Reactors Dept.
FOUR GROUPS, FOUR REGIONS CRITICALITY CALCULATION DIFFUSION CODE
H. Y. Fouad and F. H. Dimitri 1969 23 p refs
(UARAEE-85) Avail: AEC Depository Libraries

A four groups, four regions, one-dimensional diffusion code was developed for operation on the IBM 1620 computer. The three geometries, i.e. slab, cylinder or sphere, can be treated by this code. A maximum of 21 space points can be taken into consideration. Author (NSA)

N71-37051# Atomic Energy Establishment, Cairo (Egypt). Reactors Dept.
TWO GROUP, TWO REGION CRITICALITY CALCULATION DIFFUSION CODE
H. Y. Fouad and F. H. Dimitri 1969 28 p refs
(UARAEE-78) Avail: AEC Depository Libraries

A two group, two region, one dimensional diffusion code was developed operational on the IBM 1620 computer. The code was made for cylindrical geometry and its modification to slab and spherical geometry is possible. Author (NSA)

N71-37052# Atomic Energy Establishment, Cairo (Egypt). Reactors Dept.
AUTOMATIC START-UP SYSTEM FOR THE UA-RR-1 REACTOR
M. A. Hassan, I. G. Slosvitch, M. T. Aser, F. M. Abd-El-Megid, M. A. Shinaishin et al 1971 36 p refs
(UARAEE-108) Avail: AEC Depository Libraries

This ASS brings the reactor from deep subcriticality up to a certain criticality which sustains a required preset period. If this period is fixed and power goes up to the required level, then the regulating loop is switched on automatically to stabilize at this level. This ASS is simply a set of logic and sequencing circuits controlling the different standard components. New instruments were needed such as null organ and middle indicator, which were developed using transistors. Author (NSA)

N71-37053# Atomic Energy Establishment, Cairo (Egypt). Reactors Dept.
ESTIMATE FOR UAR RESEARCH REACTOR THERMAL INERTIA
E. S. Galdis, H. Y. Fouad, and M. Aboul-Fetouh 1971 16 p refs
(UARAEE-111) Avail: AEC Depository Libraries

An estimate for UAR research reactor thermal inertia was obtained through experimental measurements of the transient conditions during variation of power. The coolant time constant was found to be 450 seconds, and the corresponding equivalent thermal inertia was 16.5 tons of water inside the reactor core and 28 tons of water in the whole primary circuit. Author (NSA)

N71-37054# Atomic Energy Establishment, Cairo (Egypt). Reactors Dept.
THEORETICAL STUDY OF THE EFFECT OF TEMPERATURE ON REACTIVITY OF EK-10 TYPE REACTORS APPLYING THREE-GROUP THEORY
O. H. El-Mofty, A. A. El-Demerdash, and G. A. Karcheva 1970 21 p refs
(UARAEE-108) Avail: AEC Depository Libraries

The effect of temperature on the reactivity of a water-water reactor system with EK-10 type fuel elements is discussed. The parameters, cross-sections, thermal utilization, resonance integral, disadvantage factors, reflector saving, and the number of secondary neutrons per absorption are evaluated at different temperatures and their characteristics are discussed. The range of temperature was taken from 10 C to 40 C to avoid changing the state of water. Three-group diffusion theory and the four factor formula were applied. A comparison between the obtained results and experimental measurements showed that the three-group method gave better accuracy than the four factor formula. The reactivity obtained by the three-group technique is of 1% accuracy with respect to experimental results. Author (NSA)

N71-37055# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
NEMI: A PHYSICAL MATHEMATICAL MODEL FOR SODIUM BOILING IN A HEATED CHANNEL
A. Secco and G. Scarano 1970 36 p Presented at the 2d meeting of the Liquid Metal Boiling Working Group, Casaccia, Italy, 9-10 Apr. 1970
(RT/ING-(70)18; CONF-700439-1) Avail: AEC Depository Libraries

The NEMI code on sodium boiling in a core channel during a loss of flow or power excursion accident is described. Results are presented for the ENA-1 experimental loop geometry, for the purpose of evaluating the reliability of the physical-mathematical model by comparison with experimental data. Author (NSA)

N71-37056# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Reaktorwerkstoffe.
IRRADIATION EXPERIMENT FOR TESTING SPHERICAL FUEL ELEMENTS FOR HIGH TEMPERATURE REACTORS (TEST SK 1 IN STUDSVIK R2)
E. Gross, G. Petz, W. in der Stroeten, and W. Theymann Sep. 1970 34 p In GERMAN
(JUL-701-RW) Avail: AEC Depository Libraries

For testing spherical fuel elements that were pressure cast for the AVR nuclear power station, two elements of this type were irradiated in Studsvik R 2 under conditions corresponding to those of AVR. During the experiment, the release of various fission gas nuclides was measured. In the last reactor period, a

thermal cycling was performed. At a temperature of 1000 C on the surface of the spheres, a burnup was achieved which reached about 11% of the fissionable material. Release of Xe-133 remained below specified limits. Following irradiation, no damage could be observed on fuel elements as well as fuel particles. NSA

N71-37067# Tokyo Univ. (Japan).
PROBLEMS ABOUT FUEL CLADDING MATERIALS
Yoshitsugu Mishima 1970 3 p Presented at the Atomic Energy Society meeting, Tokyo, 12-13 Feb. 1970
(Conf-700211-9) Avail: AEC Depository Libraries

The use of Ti-V for fuel element cladding in fast breeder reactors is discussed. The effects of liquid Na on corrosion of Ti-V are described. NSA

N71-37068# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorentwicklung.
INHERENT PROPERTIES OF THE DIFFERENT PRIMARY CIRCUITS OF SODIUM COOLED REACTORS
R. A. Mueller Mar. 1971 27 p refs In GERMAN
(KFK-1379) Avail: AEC Depository Libraries

The fundamental structure of the system primary circuit of sodium-cooled reactors is analyzed. On the basis of a general description found by abstraction, additional parameters are introduced stepwise so that the variants under consideration approach the real engineered designs. The method yields a consistent scheme comprising all possible variants up to a defined degree of refinement. The inherent properties are clearly attributed to the individual variants indicated. All designs investigated and realized so far can be placed on specific positions in this family tree and thus can be definitely recognized as the specific solutions of the general system. Author (NSA)

N71-37069# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
BURNOUT IN FORCED CONVECTION BOILING HEAT TRANSFER: A BIBLIOGRAPHY
Jean Geus May 1971 23 p refs
(AAEC/LIB/Bib-286) Avail: AEC Depository Libraries

One hundred and twenty-two references are listed chronologically by year and alphabetically by author within each year. The search was restricted to NSA between 1962 and 1971. Emphasis is on uniformly and nonuniformly heated systems such as single rods, annuli and rod bundles. NSA

N71-37080# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
AECL RESEARCH IN ENGINEERING
1971 18 p refs
(AECL-3787) Avail: AEC Depository Libraries

Reviews are presented of engineering research on heavy water production using amine-hydrogen isotopic exchange; reactor closure seal analysis; vibration of reactor fuel elements; the use of freon to model dry-out in high-pressure boiling water system; in-core flux detectors for nuclear power reactors; and use of digital computation techniques. NSA

N71-37081# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Chalk River Nuclear Labs.
VALVES FOR PRIMARY HEAT TRANSPORT SYSTEMS FOR CANADIAN POWER REACTORS
D. F. Dixon Mar. 1971 23 p refs
(AECL-3858) Avail: AEC Depositories Libraries

The economics of Canadian power reactor operation is discussed, which places stringent requirements on valve performance. Low leakage to atmosphere, dependability, and maintainability are of particular interest. Most commercially available valves have weaknesses in one area or another, so test and development work was necessary to select and improve valve hardware. Test programs have screened out poor equipment and identified some problem areas. The development work has uncovered new technology which is being applied to existing reactor valve problems. Author (NSA)

N71-37082# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Reaktorentwicklung.
TEMPERATURE DISTRIBUTION AND CORROSION IN THE CORE OF AN ADVANCED HIGH TEMPERATURE REACTOR
Hans-Paul Dreecher Jan. 1971 95 p refs In GERMAN
(JUL-725-RG) Avail: AEC Depository Libraries

The design of a pebble-bed reactor for coupling in a process heat installation is considered. The core design and the damage to the core and primary circuit by corrosion are studied. The power density and temperature distributions in the core are determined. A theoretical model on the corrosion and reactor behavior is developed and applied to the high-temperature reactor. The prospects for a reactor outlet temperature of 1200 C are considered. NSA

N71-37083# Japan Atomic Energy Research Inst., Tokyo.
KINETICS PARAMETER CALCULATION CODE: ARGO
Koji Ikawa Jan. 1971 40 p refs In JAPANESE
(JAERI-Memo-4331) Avail: AEC Depository Libraries

The ARGO code is a one-dimensional (slab, cylinder, sphere), multigroup diffusion code for use in fast reactor criticality and kinetics parameter analysis. Three cross section sets, i.e., JAERI-FAST-SET, ABBN-SET, and RCBN-SET, of 28 energy groups, were prepared for the code as library tapes. The outline of the code and its input format are described. Author (NSA)

N71-37084# Atomic Energy Establishment, Cairo (Egypt).
COOLING OF A SIMULATED FUEL ELEMENT BY A FLOW OF NATURALLY CIRCULATED BOILING WATER
N. Rasfat, H. El-Fouly, E. S. Gaddis, and M. Khattab 1971 52 p refs
(UARAEE-110) Avail: AEC Depository Libraries

The cooling of a uniformly heated tube, forming the heating surface of an annular space and simulating a fuel element, by naturally circulated boiling water was investigated. It was shown that accurate prediction of the surface temperature of the heater cannot be made without taking into consideration entrance and end effects. The wall surface temperature in the subcooled region can be predicted by a knowledge of the heat transfer coefficient in the convection and nucleate boiling regions. The rate of increase of coolant mass flow rate with increase in inlet coolant temperature (also with increase in power) increased considerably once net boiling started in the test section. However, this rate of increase decreased to a low level, once the steam quality at the exit exceeded a certain value. At atmospheric conditions, the corresponding exit steam quality can be as low as 0.03, and is attributed to the high void fraction and low rate of its increase at such low steam quality. The coolant mass flow rate showed a maximum at the intermediate diameter ratio. Author (NSA)

N71-37085# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
NUCLEAR POWER AND ENVIRONMENTAL POLLUTION
D. R. Davy 1971 28 p refs
(NP-18842) Avail: AEC Depository Libraries

Operations which are a potential source of radioactive pollution, such as uranium mining, chemical reprocessing, transportation of spent fuel, and reactor systems, are discussed in terms of distribution of waste products within the environment. Evaluations of plant layout for the proposed Jervis Bay reactor are considered in this context, with particular reference to hydrographic studies related to the ecological effects of movement of large volumes of water, trade waste disposal, and dispersal of thermal effluent. Low level radioactive effluent is discussed with reference to discharge authorizations. For an

Australian facility, biological mapping is carried out to reveal the food web most limiting in terms of allowable discharges. At the AAEC research establishment and the proposed Jervis Bay power station site, the critical foods and consumption rates are oysters (70 g/day), fish (350 g/day), and milk (1.5 pints/day/1 year old child). NSA

N71-37066*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF ANGULAR QUADRATURE ON RESULTS OF TWO-DIMENSIONAL SPACE POWER REACTOR SHIELD CALCULATIONS
D. J. Connolley and G. P. Lahti 1971 10 p refs Presented at the Am. Nucl. Soc. Winter Meeting, Miami Beach, Fla., 17-21 Oct. 1971
(NASA-TM-X-67937; E-6615) Avail: NTIS CSCL 18I

The effect was studied of angular quadrature on the results of two-dimensional transport calculations made to evaluate radiation environment in the vicinity of a shielded space power reactor. The application considered is for a manned space station; crew shielding must be provided within a 25 deg cone angle. The asymmetric shield layout is evaluated using the two-dimensional transport code DOT. Within the shield, an S8 angular quadrature yields satisfactory results. For regions where the ray effect may occur it is not apparent that an S10 quadrature is adequate. Anomalies in results due to transport of particles in a void, and necessary geometric approximations were observed. Author

N71-37067*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE OPEN-CYCLE GAS-CORE NUCLEAR ROCKET ENGINE: SOME ENGINEERING CONSIDERATIONS
Maynard F. Taylor, Charles L. Whitmarsh, Jr., Paul J. Sirocky, Jr., and Louis C. Iwanczyk 1971 5 p refs Presented at the 2nd Symp. on Uranium Plasmas, Atlanta, 15-17 Nov. 1971
(NASA-TM-X-67932; E-6588) Avail: NTIS CSCL 21F

A preliminary design study of a conceptual 6000-MW open-cycle gas-core nuclear rocket engine system was made. The engine has a thrust of 44,200 lb and a specific impulse of 4400 sec. The nuclear fuel is uranium-235 and the propellant is hydrogen. Critical fuel mass was calculated for several reactor configurations. Major components of the reactor (reflector, pressure vessel) and the waste heat rejection system were considered conceptually and were sized. Author

N71-37068*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SPLIT-CORE HEAT-PIPE REACTORS FOR OUT-OF-PILE THERMIONIC POWER SYSTEMS
G. Niederauer, E. Lantz, and R. Breitweiser 1971 8 p Presented at the Am. Nucl. Soc. Winter Meeting, Miami Beach, Fla., 17-21 Oct. 1971
(NASA-TM-X-67939; E-6605) Avail: NTIS CSCL 18I

The concept of splitting a heat-pipe reactor for out-of-core thermionics into two identical halves and using the resulting center gap for reactivity control is described. Short Li-7-W reactor heat pipes penetrate the axial reflectors and form a heat exchanger with long heat pipes which wind through the shield to the thermionic diodes. With one reactor half anchored to the shield, the other is attached to a long arm with a pivot behind the shield and swings through a small arc for reactivity control. A safety shim prevents large reactivity inputs, and a fueled control arm drive shaft acts as a power stabilizer. Reactors fueled with U-235C and with U-233C were studied. Author

N71-37069*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE POTENTIAL OF GAS-CORE AND FUSION ROCKETS: A MISSION APPLICATIONS SURVEY
Laurence H. Fishbach and Edward A. Willis, Jr. 1971 17 p refs Presented at the 2nd Symp. on Uranium Plasmas: Res. and Appl., Atlanta, 15-17 Nov. 1971
(NASA-TM-X-67940; E-6547) Avail: NTIS CSCL 21F

An evaluation of the performance potential of five nuclear rocket engines for four mission classes is presented. These engines are: (1) the regeneratively cooled gas-core nuclear rocket, (2) the light bulb gas-core nuclear rocket, (3) the space-radiator cooled gas-core nuclear rocket, (4) the fusion rocket, and (5) an advanced solid-core nuclear rocket which is included for comparison. The missions considered are: (1) Earth-to-orbit launch, (2) near-Earth space missions, (3) close interplanetary missions, and (4) distant interplanetary missions. For each of these missions, the capabilities of each rocket engine type are compared in terms of payload ratio for the Earth launch mission or by the initial vehicle mass in Earth orbit for space missions (a measure of initial cost). Other factors which might determine the engine choice are discussed. It is shown that a 60 day manned round trip to Mars is conceivable. Author

N71-37070*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FABRICATION AND TESTING OF TUNGSTEN HEAT PIPES FOR HEAT PIPE COOLED REACTORS
Robert J. Bacigalupi 1971 7 p refs Presented at the Thermionic Conversion Specialists Conf., San Diego, Calif., 4-6 Oct. 1971
(NASA-TM-X-67941; E-6620) Avail: NTIS CSCL 18I

The heat pipes described here were designed and fabricated with the following criteria in mind: operation at 1650 K in contact with nuclear fuel; axial heat flux greater than 7 kW/sq cm; and a configuration allowing direct coupling to a cross flow heat pipe heat exchanger. Chemically vapor deposited tungsten was used as the outer shell and lithium as the working fluid. Both annular and channeled wicks were investigated along with methods of wick fabrication using tungsten and tungsten rhenium. Calorimetric heat throughput measurements at various operating temperatures are presented. Author

N71-37071# Oak Ridge National Lab., Tenn.
ORNL-SNAP SHIELDING PROGRAM
F. R. Mynatt, C. E. Clifford, F. J. Muckenthaler, and M. L. Gritzner 1 Apr. 1971 28 p refs Presented at Symp. on Natural and Manmade Radiation in Space, Las Vegas, 1-5 Mar. 1971 Sponsored by AEC
(ORNL-TM-3384; Conf-710304-12) Avail: NTIS

The effort in the ORNL-SNAP shielding program is directed toward the development and verification of computer codes using numerical solutions to the transport equation for the design of optimized radiation shields for SNAP power systems. A brief discussion is given for the major areas of the SNAP shielding program which are: cross-section development, transport code development, and integral experiments. Detailed results are presented for the integral experiments utilizing the TSF-SNAP reactor. Calculated results are compared with experiment for neutron and gamma ray spectra from the bare reactor and as transmitted through slab shields. Author (NSA)

N71-37072# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
STATISTICAL TECHNIQUE FOR DETERMINING SOURCES OF VARIATION IN (U,Pu)O2 OXYGEN-TO-METAL RATIO
W. J. Lackey, R. A. Bradley, W. H. Pechin, and T. L. Hebble Jun. 1971 21 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3362) Avail: NTIS

With a statistically designed experiment it was demonstrated that gravimetric determinations of the oxygen-to-metal ratio of (U,Pu)O2 depend strongly on the day of analysis, slightly on the particular sintering run, and not detectably on position in either the sintering furnace or the analysis furnace. The average oxygen-to-metal ratio of a single sintering run can be determined to a precision of + or - 0.005 at the 95% confidence level. Author (NSA)

N71-37073# General Electric Co., Pleasanton, Calif. Nucleonics Lab.
THERMODYNAMIC DATA PROGRAM INVOLVING PLUTONIA AND URANIA AT HIGH TEMPERATURES
Quarterly Report, 1 Nov. 1970 - 31 Jan. 1971
E. A. Aitken, M. G. Adamson, S. K. Evans, and T. E. Ludlow Jan. 1971 14 p refs
(Contract AT(04-3)-189)
(GEAP-12182; QR-14) Avail: NTIS

Work progress is reported in the continuing scope of work related to vaporization of uranie in uranie-plutonia solid solutions, oxygen activities at high temperatures, oxygen redistribution in a temperature gradient, Pu/U segregation and sodium-fuel interactions. Author (NSA)

N71-37074# Skoda Works, Pilsen (Czechoslovakia). Nuclear Power Plants Div.
REMOTE MEASUREMENTS OF INSTANTANEOUS RATE OF UNIFORM CORROSION OF ALUMINUM ALLOYS IN WATER BY METHOD OF POLARISATION RESISTANCE
J. Beran and J. Sulc 1970 15 p refs
(ZJE-96) Avail: AEC Depository Libraries

At parameters approaching actual conditions in the heavy water circuit of an A-1 reactor the applicability of the method of remote measurement of the instantaneous rate of uniform corrosion by means of polarization resistance was successfully verified. The optimum working procedure ensuring the reproducibility of the results was defined. The applicability of the method to the solution of various problems which cannot be solved satisfactorily by conventional methods for corrosion evaluation was demonstrated using practical examples. Author (NSA)

N71-37075# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
MEASUREMENT OF THE TEMPERATURE DEPENDENCE OF k SUB INFINITY FOR A (U-233)O2-ThO2 HTGR LATTICE
E. P. Lippincott May 1971 92 p refs
(Contract AT(45-1)-1830)
(BNWL-1561) Avail: NTIS

The infinite medium multiplication factor was found to decrease by .0350 + or - .0015 from 20 C to 1000 C. This result provides direct information necessary in the design of the control system and in the safety analysis for advanced high-temperature gas-cooled reactors. Author (NSA)

N71-37076# Idaho Nuclear Corp., Idaho Falls.
METALLURGICAL EVALUATION OF SIMULATED BWR EMERGENCY CORE COOLING TESTS
M. J. Graber, W. F. Zaleszny, and R. E. Schmunk Mar. 1971 51 p refs
(Contract AT(10-1)-1230)
(IN-1453) Avail: NTIS

Three bundles of 49 simulated boiling-water-reactor fuel rods were exposed to emergency core cooling tests to determine the response of Zircaloy-2 tubing. During these tests, electrically heated rods were exposed to the temperature and steam atmosphere conditions expected during emergency core cooling following a loss-of-coolant accident in a boiling water reactor. A metallurgical examination and evaluation showed that the tubes were attacked by the steam and by alumina insulator material. The reaction between the alumina and the Zircaloy-2 resulted in unexpected temperature excursions and increased embrittlement of the cladding. Author (NSA)

N71-37077# Battelle Memorial Inst., Columbus, Ohio.
AN EVALUATION OF THE APPLICABILITY OF EXISTING DATA TO THE ANALYTICAL DESCRIPTION OF A NUCLEAR-REACTOR ACCIDENT Quarterly Progress Report, Jan. - Mar. 1971
Wayne A. Carbiener and Robert L. Ritzman Apr. 1971 24 p refs
(Contract W-7405-eng-92)
(BMI-1904) Avail: NTIS

Selected topics include: development of heat transfer models for analysis of iodine and fission products deposition in reactor containment buildings; reactor containment structures; an analytical description of coolant loss accidents in water cooled reactors; an emergency core cooling system for boiling water reactors; an analytical description of coolant loss accidents in presurized water reactors; and codes for thermal-hydraulic analysis of coolant loss accidents in water cooled reactors. J.G.M.

N71-37078# Du Pont de Nemours (E. I.) and Co., Aiken, S.C.
EXPERIMENTAL INVESTIGATION OF THE EFFECTS OF SPACE AND REFLECTION ON THE COUNT RATE FLUCTUATION SPECTRA OF A LARGE NUCLEAR REACTOR
Cecil Owen Thomas, Jr. (Ph.D. Thesis - Tenn. Univ., Knoxville) Mar. 1971 121 p refs Sponsored by AEC
(DP-MS-70-101) Avail: NTIS

The effects of space and a reflector on count-rate fluctuation spectra obtained from a nuclear reactor, and the spatial behavior of the correlated-to-uncorrelated ratio, which is proportional to the detector efficiency of a large nuclear reactor, were investigated. Tape recordings were made of the output signals of neutron detectors placed along an axially-centered diameter of a large, cylindrical nuclear reactor for both reflected and nonreflected radial boundary conditions. Data were taken for cases in which the detectors were located together and symmetrically, and for cases in which one detector was always located at the center of the reactor. The magnitudes of the cross-power-spectral-densities were found to exhibit both space and reflector effects. The phases of the cross-power-spectral-densities were found to deviate from zero only when the detectors were located neither together nor symmetrically. The space dependence of the correlated-to-uncorrelated ratio was found to be described by that of the average count rates obtained from the neutron detectors. Author (NSA)

N71-37079# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.
EFFECTS OF BURNUP ON FUEL PIN THERMAL PERFORMANCE
A. Biancheria, U. P. Nayak, and M. S. Beck [1970] 30 p refs Presented at Conf. on Fast Reactor Fuel Element Technol., New Orleans, 13 Apr. 1971
(Contract AT(30-1)-4210)
(Conf-710414-1) Avail: NTIS

The development of models for analyzing the thermal performance of fast reactor mixed oxide fuel pins throughout life is presented. The models provide a capability for examining the interrelationship between the various kinetic phenomena occurring in fuel pins. Emphasis is placed on gap conductance behavior. The factors which influence thermal behavior as burnup proceeds are discussed. Preliminary application of the models to fast reactor operating conditions is presented. The results reveal the competing effects on thermal performance of fission gas dilution of the bond gas, fission gas pressure, gap closure rates and restructuring kinetics. The importance of a restraint-dependent fuel swelling model to thermal behavior was also revealed by these studies. Author (NSA)

N71-37080# WADCO Corp., Richland, Wash.
ROTATING WIRE SPACER MODEL IN LARGE BUNDLE THERMAL-HYDRAULICS
Donald C. Kolesar Mar. 1971 18 p refs
(Contract AT(45-1)-2170)
(WHAN-SA-76) Avail: NTIS

Extensions of the COBRA heat transfer codes to large liquid Na cooled pin bundles and coolant mixing effects due to the presence of fuel pin spacer wires are described. Bundle sizes of up to 217-pins are considered. Wire rotation models which

require only a few input parameters to characterize the complete set of interchannel mixing rates are proposed. Movement of the fluid along the duct (fuel pin container) wall in the direction of wire rotation is predicted by the models. Limitations on the code parameters due to the simulation of a boundary value problem with an initial value problem are discussed. Comparisons of the COBRA results with experimental data were successful where attempted. Author (NSA)

N71-37081# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
DESTRUCTIVE AND NONDESTRUCTIVE BRUNUP DATA FROM NATURAL UO2 FUEL
D. E. Christensen and R. P. Matsen May 1971 156 p refs
(Contract AT(45-1)-1830)
(BNWL-1568) Avail: NTIS

Experimental burnup data collected from spent UO2 fuels which were irradiated in the PRTR are documented. One hundred sixty-five fuel samples were chemically analyzed to obtain total U and Pu concentrations, U and Pu isotopic compositions, and fission product concentration data. Three fuel rods were nondestructively analyzed by gamma scanning which included both continuous scanning of the fuel rods to obtain axial gamma ray activity profiles and incremental scanning to obtain high resolution gamma ray spectra at selected points. Preliminary analyses of the data were done as well as documentation of additional information necessary for complete analysis and correlations between experiment and theory.
Author (NSA)

N71-37082# Bettis Atomic Power Lab., Pittsburgh, Pa.
PRESSURIZED WATER REACTOR(PWR) PROJECT Technical Progress Report, 24 Oct. 1970 - 25 Jan. 1971
25 Jan. 1971 18 p
(Contract AT(11-1)-Gen-14)
(WAPD-MRP-135) Avail: NTIS

Plant operations and testing on two, three and four reactor coolant loops continued satisfactorily during the period and the total operating time with PWR-2 Seed 2 was increased to approximately 4760 equivalent full power hours (EFPH). The reactor plant was operated at full power (150 MW(e)) at about 4700 EFPH for the third time during Seed 2 lifetime to demonstrate full power capability. PWR-2 Seed 2 power capability was re-evaluated for swing load and full power operation for the interval from 4000 to 5500 EFPH using a modified control rod program and revised operating limits were implemented. Measured coolant flows at all core locations remained in excess of design values. Author (NSA)

N71-37083# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
ALTHAEA: A ONE-DIMENSIONAL TWO-GROUP DIFFUSION CODE WITH AN EFFECTIVE FOUR GROUP BURNUP
E. T. Merrill May 1971 111 p refs
(Contract AT(45-1)-1830)
(BNWL-462) Avail: NTIS

The ALTHAEA code systems calculate nuclear reactor fuel burnups with reasonable accuracy and at computer speeds sufficient for preliminary economic analysis of fuel cycle costs. This first version of the code describes four neutron energy groups, and collapses these to two groups for one-dimensional space diffusion calculations. It provides for cross shielding of the epithermal resonances. It is written in FORTRAN II for the IBM 7090, or FORTRAN IV for the Univac 1108 computer.
Author (NSA)

N71-37084# Argonne National Lab., Ill. Reactor Analysis and Safety Div.
SPACE-DEPENDENT TRANSFER-FUNCTION ANALYSIS OF LARGE NUCLEAR-REACTOR POWER SYSTEMS
L. J. Habegger and C. Hsu Mar. 1971 63 p refs
(Contract W-31-109-eng-38)
(ANL-7788) Avail: NTIS

The importance of spatial effects in proposed transfer-function measurements in large, fast reactors was investigated. A general theoretical formulation of space-dependent transfer functions is derived which includes the effects of spatial characteristics of input and output devices. A quantitative indication of spatial effects is given by numerical simulation of measured transfer functions in a liquid metal fast breeder reactor. A general space-time reactor model and approximate method of solution using the Galerkin's procedure were developed in conjunction with the investigation. A quasilinearization procedure was used to obtain the equilibrium states which were the solution of multipoint, boundary-value problems.
Author (NSA)

N71-37085# Oak Ridge National Lab., Tenn.
OAK RIDGE SYSTEMS ANALYSIS CODE (ORSAC) USER'S MANUAL
F. G. Welfare, O. L. Culberson, R. C. Durfee, E. H. Gift, S. C. Jacobs et al Jun. 1971 118 p
(Contract W-7405-eng-26)
(ORNL-TM-3223) Avail: NTIS

ORSAC program consists of a combination of SYSCO, and MPS/360, a mathematical programming package. The codes, used together, allow the calculation of the combination of power plants which will provide a given electrical capacity in the United States at the minimum cost. Intermediate results include the economic and fuel utilization characteristics of each nuclear or fossil plant type being considered in the system. A full description of the ORSAC code is presented. Author (NSA)

N71-37086# Hanford Engineering Development Lab., Richland, Wash.
FTR DRIVER FUEL DEVELOPMENT PROGRAM STATUS
J. E. Hanson and W. E. Roake Apr. 1971 30 p refs
Presented at the Conf. on Fast Reactor Fuel Element Technol., New Orleans, 13 Apr. 1971
(Contract AT(45-1)-2170)
(HEDL-SA-81; Conf-710414-2) Avail: NTIS

The capability of the FTR driver fuel to perform satisfactorily at the initial operating conditions of the reactor is analyzed. Radiation testing data are reviewed. Author (NSA)

N71-37087# United Kingdom Atomic Energy Authority, Harwell (England).
EXTENSION OF THE EXPERIMENTAL CAPABILITIES OF THE MR REACTOR FOR LOOP TESTING FUEL ELEMENTS AND MATERIALS
V. V. Goncharov et al May 1970 26 p refs Transl. into ENGLISH from the Russian report IAE-1925 Presented at the Joint UK/USSR Seminar on the Operation and Use of Res. and Testing Reactors, Harwell, England
(LB/G-9001; CONF-691060-4; IAE-1925) Avail: AEC Depository Libraries

A description is given of the main modifications that have been carried out to the MR reactor in order to extend its experimental capabilities. As a result of the modernization of the reactor and other modifications carried out subsequently, the number of loop channels that can be installed in the reactor for testing experimental fuel elements has been more than doubled (from 13 to 27). Since its modernization, the reactor has an available power of 40 MW, or, with the loop channels, 50 MW.
Author (NSA)

N71-37088# Atomic Energy Establishment, Cairo (Egypt). Reactor and Neutron Physics Dept.
NUMERICAL CALCULATIONS OF Keff AND NEUTRON FLUXES IN THE 2 AND 3 GROUP APPROXIMATIONS USING AN IBM-1620 CODE
K. Naguib, G. Karchava, and I. Hamouda 1970 55 p refs
(UARAEE-89) Avail: AEC Depository Libraries

An IBM 1620 code is described to calculate in the two- and three-group diffusion approximations the critical parameters of one-dimensional multiregion reactors with preset geometrical and physical core characteristics. The code permits the calculation of the central control rod worth as well as the neutron distribution in the unit lattice cell. The results of test calculations are also presented. Author (NSA)

N71-37089# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
THERMIC CALCULATIONS ON WATER COOLED RESEARCH REACTORS
Serge Fabrega Mar. 1971 106 p refs In FRENCH
(CEA-R-4114) Avail: AEC Depository Libraries

The formula and the more important numerical data necessary for thermic calculations on the core of a research reactor, cooled with low pressure water, are presented. Most of the problems met by the designer and the operator are dealt with (calculations margins, cooling after shutdown). Particular cases were considered (gas release, rough walls, partially rough walls, asymmetric cooling slabs, attenuation of the defects by conduction), which are not generally envisaged in works on general thermics. A list of instructions for the IBM program (written in FORTRAN 4) is given in a supplement. This list allows real applications to be studied in a complete and precise manner when the complexity is such that the direct employment of the formula is, in general, only adequate in the first approximation. Author (NSA)

N71-37090# Commissariat a l'Energie Atomique, Fontenay-Aux-Roses (France). Centre d'Etudes Nucleaires.
ODILE IRRADIATION DEVICE
Denis Feges, Jean-Claude Lauthier, Jacques Leclere, and Andre Lhermenier [1970] 41 p refs Sponsored by AEC-Euratom
(EURFNR-889) Avail: NTIS

For experimental irradiations of fast reactor project fuels, a device to be used in pool type reactors, Osiris or Siloe, was designed and fabricated. Its main features are: static Na cooling, the Na being always kept liquid by electrical heaters; temperature adjustment by variable thermal barrier; flux adjustment by moving towards reactor core; and the ability to take neutrographies. Capable of evacuating more than 800 W/cm for small elements, the device Odile meets most of the requirements for fast reactor project irradiations. NSA

N71-37091# International Atomic Energy Agency, Vienna (Austria).
ASPECTS OF CRITICAL EVALUATION OF NUCLEAR DATA INFORMATION
J. J. Schmidt Dec. 1970 12 p refs Presented at the 2d Intern. CODATA Conf., St. Andrews, Scotland
(INDC(NDS)-29-U; CONF-700949-1) Avail: AEC Depository Libraries

Some aspects of critical evaluation of nuclear data information are discussed, particularly in relation to the data needs of nuclear-reactor designers. These aspects comprise filling gaps in experimental data, establishing and guaranteeing inner consistency among evaluated data, and detecting and removing systematic errors of experimental data. Recently, a unique computer format called EXFOR for the coding and international exchange of experimental neutron data information was developed in a cooperative effort of the four world neutron data centers at Brookhaven, Obninsk, Saclay (ENEA), and Vienna (IAEA). This system will not only contain the experimental data together with statistical and systematic errors and the pertinent bibliographic information, but also additional detailed physical information related to the measurement conditions. Author (NSA)

N71-37092# Scientific Research Atomic Reactor Inst., Melekess (USSR).
SPECIFIC PROPERTIES OF OPERATION OF ABSORBING MATERIALS IN FAST REACTORS AND REQUIREMENTS FOR THEM
N. V. Krasnoyarov, V. P. Goltsev, V. M. Gryazev, T. M. Guseva, and V. I. Ponomarev 1970 16 p refs In RUSSIAN
(SRARI-P-96) Avail: AEC Depository Libraries

The possible methods of fast reactor control were investigated. The most effective method for large reactors is the use of absorbers. The control rods of different purpose and requirements for them are described. The behavior of absorbing materials from the point of view of their radiation damage and ensuring the operation reliability are considered. Author (NSA)

N71-37093# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Neutronenphysik und Reaktortechnik.
MEASUREMENT OF THE DOPPLER COEFFICIENT IN DIFFERENT FUEL SAMPLES IN A FAST AND AT FAST THERMAL REACTOR ARRANGEMENT BY THE PILE OSCILLATOR METHOD
L. Barleon Dec. 1970 120 p refs In GERMAN
(KFK-1350) Avail: AEC Depository Libraries

In the critical zero energy assemblies STARK and SNEAK the pile oscillator technique was used to measure the Doppler effect with heated small samples. A detailed description of the new developed apparatus and the technique used is given. The samples are placed in fuel filled elements, in order to avoid perturbation of the neutron spectrum in the vicinity of the sample. Because such an element weighs up to 80 kg, a powerful pneumatic drive was needed to move it. Detailed calculations and experiments were made to study the temporal movement of these heavy elements. The heat losses of the heated samples were calculated and measured. Measurements of samples of depleted UO2 and of metallic natural uranium made in STARK are reported. The experiments were compared to calculations, using various theories and nuclear data sets. Author (NSA)

N71-37094# Atomic Energy Establishment, Cairo (Egypt). Reactors Dept.
PRELIMINARY REPORT ON THE AUTOMATIC START-UP SYSTEM FOR THE WWR-S
I. Sicivitch, M. S. Azer, and S. A. Saleh 1970 18 p refs
(UARAEE-94) Avail: AEC Depository Libraries

In research reactors where it is required to operate and shut down many times each day, it is preferable to have an automatic start-up system. This overcomes the difficulties of continuous power and period monitoring by the operator. A good automatic start-up system will also eliminate the possiblity of scram due to inadequate rod motion which is liable in manual start-up. A schematic diagram and preliminary block diagrams for such a system are presented. Author (NSA)

N71-37095# Idaho Nuclear Corp., Idaho Falls.
ZIRCONIUM FUEL REPROCESSING CAMPAIGN OF 1970
R. N. Henry and G. F. Offutt Apr. 1971 25 p refs
(Contract AT(10-1)-1230)
(IN-1471) Avail: NTIS

Zirconium-uranium alloyed fuels were again processed during 1970. Improvements over previous campaigns in processing rates, waste generation rates, and uranium recovery were realized. A head-end centrifuge was used for the first time to clarify feed to the extraction system, and this unit contributed significantly to improved performance of the system. Author (NSA)

N71-37096# Gulf General Atomic, San Diego, Calif.
LIGHTWEIGHT, LOW-BALLISTIC COEFFICIENT, RADIOISOTOPE FUELED CAPSULE PROTOTYPE DEVELOPMENT PROGRAM Final Report
F. D. Postula, N. B. Elsner, and M. D. Emken May 1971 191 p refs
(Contract AT(29-2)-2886)
(GA-8998) Avail: NTIS

A program was completed for developing a capsule which would provide safe containment of a 700 W(t) radioisotope heat source using PuO2 microsphere fuel. The final design is spherical, employs a tantalum alloy refractory structure and can readily be scaled over the power range from 500 to 1500 W(t). An extensive material evaluation testing program was undertaken to establish hafnia and pyrolitic carbon coatings for thermal protection and tungsten coatings for material compatibility. Prototype capsule tests were conducted to verify the design. All aspects of the capsule fabrication and assembly were developed based upon requirement for radioisotope fueling. Specific techniques were developed for: the hydroforming of components; assembly by electron beam welding tantalum alloy parts; and chemical vapor deposition and plasma spraying of protective coatings. Author (NSA)

N71-37097# Sandia Corp., Albuquerque, N.Mex.
IMPACT TESTS: RADIOISOTOPE FUELS AND SIMULANTS
W. J. Delby Apr. 1971 84 p refs
(SC-DR-710218) Avail: NTIS

The chronology is given of the impact testing of radioisotope fuels and simulants subsequent to the plasma-fired Pu-238O2 microsphere and samaria-tungsten cermet impact tests. Thirty three individually encapsulated discs were impacted singly. Author (NSA)

N71-37098*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RADIOLYSIS OF WATER IN SEALED ALUMINUM CAPSULES: ITS PREDICTION AND INHIBITION
Dean W. Sheibley Washington Oct. 1971 14 p refs
(NASA-TM-X-2407; E-6455) Avail: NTIS CSCL 18K

Measurements to the radiolysis of water were used to develop predictive models for the pressure rise in reactor experiments containing water with air as the cover gas and with cover gases of helium containing air impurities as well as mixtures of hydrogen, oxygen, and nitrogen impurities. The effectiveness of pure helium for inhibiting radiolysis was demonstrated by in-pile experiments. Oxides of nitrogen were identified as the key to radiolysis behavior. To prevent radiolysis, air or mixtures of nitrogen and oxygen must be excluded from the system. Author

N71-37099# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Radiochemie.
DETERMINATION OF TRACES OF FLUORIDE, CHLORIDE, AND BORON IN PLUTONIUM-CONTAINING OXIDE FUELS [BESTIMMUNG VON FLUORID-, CHLORID-, UND BORSPUREN IN PLUTONIUMHALTIGEN OXIDISCHEN KERNBRENNSTOFFEN]
E. Mainka and W. Coerdt Jan. 1971 24 p refs In GERMAN
(KFK-1360) Avail: AEC Depository Libraries

The determination of fluorine, chlorine, and boron in oxide fuels is described. These elements were separated from the matrix by pyrohydrolysis. This is a simple, rapid, and quantitative method. The determinations of fluoride and chloride are based on potential measurements of a fluoride- or chloride-sensitive electrode, versus a mercury sulfate electrode. A spectrophotometric method was used for determination of boron. Author (NSA)

N71-37100 National Lending Library for Science and Technology, Boston Spa (England).
ON THE VALIDITY OF VEGARD'S LAW FOR UC-UN SOLID SOLUTION
Hiroshi Kai et al [1970] 123 p refs Transl. into ENGLISH from J. Atomic Energy Res. Inst. (Japan), v. 12, 1970 p 116-123 In ENGLISH and JAPANESE
(NLL-Windscale-442-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

A discussion is given on the validity of Vegard's law for UC-UN solid solutions. The factors taken up include oxygen contamination, errors of chemical rate, nonstoichiometry of solid solution, coexisting second phase, and the state of distribution of carbon and nitrogen atoms in the UC-UN lattice. Experiments were performed in vacuo and in nitrogen gas in order to obtain the relation between the lattice parameter and the composition of solid solution, and to determine the effects brought upon the relation by the factors cited. The lattice parameters of UC-UN solid solution obtained by vacuum sintering at 1700 and 1900 C showed a positive deviation from Vegard's law. The same parameters when the solid solution coexisted with UC2 deviated similarly from Vegard's law. The presence of oxygen in the UC-UN solid solution caused little change of lattice parameters in the vicinity of a composition of UC(0.5)N(0.5). Author

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N71-37101*# California Univ., San Diego. Dept. of Applied Physics and Information Science.
QUANTUM DETECTION THEORY
Carl W. Helstrom [1971] 132 p
(Contract NGL-05-009-079)
(NASA-CR-121764) Avail: NTIS CSCL 20F

Statistical estimation theory techniques for evaluating the attendant limitations on the measuring power of an optical instrument are outlined. A discussion is presented of the detection theory and its application to binary detection, discrete data and randomization, composite hypotheses, threshold detection, and multiple hypotheses. The detection theory in quantum mechanics, detection of a coherent signal, modal decomposition of aperture fields, detection of coherent light, and the estimation theory are included. J.M.

N71-37102*# Scientific Translation Service, Santa Barbara, Calif.
STUDIES OF THE DIFFRACTION OF LIGHT WITH ULTRASONIC WAVES. 2: COMMUNICATION: DIFFRACTION OF LIGHT WITH ULTRASONIC WAVES FOR OBLIQUE INCIDENCE OF THE LIGHT ON THE SOUND WAVE FRONT. BRAGG REFLECTION [STUDIEN UBER DIE BEUGUNG NON LICHT AN ULTRASCHALLWELLEN. 2: MITTEILUNG: BEUGUNG VON LICHT AN ULTRASCHALLEN BEI SCHIEFEM EINFALL DES LICHTES AUF DIE SCHALLWELLENFRONT. BRAGGSCHE REFLEXION]
Otohiko Nomoto Washington NASA Oct. 1971 32 p refs Transl. into ENGLISH from Proc. Phys. Math. Soc. of Japan (Japan), v. 24, 1942 p 618 - 639
(Contract NASw-2035)
(NASA-TT-F-13994) Avail: NTIS CSCL 20F

Several experiments on the diffraction of light with advancing ultrasonic waves were carried out for oblique incidence of the light on the sound wave front. Ultrasonic frequencies of 3.22 and 4.71 MHz were used in a liquid (transformer oil) having an ultrasonic velocity of about 1500 m/sec. The sonic field depths (lengths of the light paths in the acoustic field) were 80 mm. The diffraction spectra were recorded at various angles of incidence and the intensity distributions of the diffracted light were measured using a photographic-photometric method for the various orders. The intensity of the diffraction spectra was obtained as a function of the incidence angle in this way. The diffraction spectra showed very pronounced intensity maxima at the Bragg incident angles. Author

N71-37103*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ON PROPAGATION OF LONG WAVES IN CURVED DUCTS
W. Rostafinski and F. Buckens (Louvain Univ., Belgium) 1971 15 p refs Presented at the Acoustical Soc. of Am. Fall Meeting, Denver, 19-22 Oct. 1971
(NASA-TM-X-67944; E-3748) Avail: NTIS CSCL 20N

The problem of propagation of long acoustic waves in slightly and sharply curved ducts is solved. Two acoustic systems are considered which allow determination of the basic modes of motion and describe the transition and distortion of plane waves as they propagate down the curved channel. A detailed study of the behavior of waves in junctions between straight and curved ducts is also given. Solutions and expressions for principal modes of the wave are obtained by using the linearized equation of motion solved for its characteristic values. Bessel functions were used to determine the characteristic values of the steady and the decaying fields of motion. Author

N71-37104*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
INVESTIGATION OF EXTERNAL REFRIGERATION SYSTEMS FOR LONG-TERM CRYOGENIC STORAGE
Summary Report, 22 Dec. 1969 - 22 Feb. 1971
H. L. Jensen, T. C. Nast, A. P. M. Glassford, R. M. Vernon, and W. F. Ekarn 22 Feb. 1971 27 p refs
(Contract NAS9-10412)
(NASA-CR-115192; LMSC-A984159) Avail: NTIS CSCL 20L

Refrigeration analyses and data provide guidelines for determining the performance, weight, and size of a complete refrigeration system and for evaluating the usefulness of cryogenic systems in space applications. Reports, data sheets, and development progress on small refrigerators were reviewed. Power supplies were also studied and descriptive information was developed on all types that might be used with refrigerators. Evironmental conditions were evaluated to establish thermal properties. Refrigeration analyses were conducted to develop processes and methods for the estimation of cool down times, performance over operating regions where no data presently exists, and refrigerator characteristics at various heat rejection temperatures. Most analyses involved modifications of existing data, considering ideal performance characteristics. Failure properties of cryogenic regrigerators were examinined. Anlyses of waste heat rejection and heat absorption methods were performed. Methods of transferring heat from the cryogenic tank to the refrigerator were also investigated. The refrigerators were of the closed cycle type. K.P.D.

N71-37105*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
INVESTIGATION OF EXTERNAL REFRIGERATION SYSTEMS FOR LONG TERM CRYOGENIC STORAGE System Review Report
H. L. Jensen, T. C. Nast, and A. P. M. Glassford 28 May 1970 152 p refs
(Contract NAS9-10412)
(NASA-CR-115191; LMSC-A903162) Avail: NTIS CSCL 20L

The current available information on small refrigerator systems that are applicable to in-space cryogenic cooling operations is summarized. Most of the data is applicable to cooling loads of 1 to 100 watts. Refrigeration systems, technical analyses, and parametric studies are reviewed in relation to design trade off information that may be used for external refrigeration system selection and optimization for a variety of space applicable cryogenic tanks. The refrigeration capacity of interest is between 5 and 100 watts at temperatures from 20 to 110 K. Application of the systems is for single and double walled cryogenic tanks from 20 to 200 cu ft in size. Mission durations of interest are from 6 to 24 months and heat rejection sink temperatures range from 20 to 110 K. Data and material available on existing and prototype systems were reviewed. Author

N71-37106# Science Research Council, London (England).
A PROPOSED PROGRAMME OF SUPPORT FOR THE PHYSICS OF SURFACES
Jan. 1971 19 p refs
Avail: NTIS

Outline proposals from six universities for five year program of work on the physics of surfaces are presented. Experimental and theoretical techniques recommended for further study include low energy electron diffraction, reflection high energy electron diffraction, high energy electron diffraction, and Auger spectroscopy. J.M.

N71-37107# Pennsylvania State Univ., University Park. Dept. of Mechanical Engineering.
NOISE GENERATION DURING BUBBLE GROWTH IN A NUCLEATE BOILING SYSTEM
Gordon Edward Robinson (Ph.D. Thesis) Mar. 1970 124 p refs Sponsored in part by Naval Ordnance Systems Command and AEC
Avail: NTIS

A study of an isolated bubble in the pool boiling of water is discussed. The objectives of the study are: (1) to investigate the pressure disturbances associated with the growth of an isolated bubble in a pool boiling system and to determine the parameters which effect the magnitude and time dependency of these disturbances, (2) to measure the pressure disturbances associated with bubble growth under various conditions, and (3) to compare the characteristics of bubble growth and thus determine the major mechanism for producing noise. Author

N71-37108# Sandia Labs., Albuquerque, N.Mex.
INVESTIGATION OF ISOTHERMAL COMPRESSIBILITY OF IGNEOUS ROCKS UNDER PRESSURES OF UP TO 32,000 kg(force)/sq cm
D. S. Saleshov 19 May 1971 22 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Fiz. Zemlin (USSR), no. 2, 1971 p 24-32
(SC-T-713031) Avail: NTIS

The dislocation method of plunger-pistons in a piezometer was used to investigate the relative change of the volume of the following rock species: granite, basalt, gabbronorite, and dunite, under conditions of a quasi-hydrostatic pressure of 32,000 kg/sq cm. The isothermic volume compressibility was determined and the density was calculated for the investigated rock types. The data on the isothermic volume compressibility were compared with the corresponding data on static measurements found in literature. Author

N71-37109# Sandia Labs., Albuquerque, N.Mex.
CALCULATION OF THE VAPOR PRESSURE IN DESICCATED-MULTICOMPONENT SYSTEMS
J. Matsko, W. E. Slade, and R. H. Dungan Mar. 1971 49 p refs Sponsored by AEC
(SC-DR-710074) Avail: NTIS

A method of calculating the equilibrium vapor pressure in closed desiccated systems is presented. The calculation is based upon the principle that at equilibrium, the amount of adsorbed water is a known function of the moisture vapor pressure surrounding a material. Computer programs are presented to handle the large amount of data required for typical calculations. A typical calculation is presented in some detail to illustrate the computational procedure. The preferred method of calculation results in design charts illustrating the effect of desiccant and moisture input amount on the equilibrium vapor pressure of the system. The use of these charts enables the designer to estimate the amount of desiccant required to maintain the relative humidity below prescribed limits. Author (NSA)

N71-37110# Cornell Univ., Ithaca, N.Y. Lab. of Atomic and Solid State Physics.
HIGH PRESSURE BEHAVIOR OF SOLID H SUB 2, D SUB 2, He-3, He-4, AND Ne-20

E. L. Pollock, T. A. Bruce, G. V. Chester, and J. A. Krumhansl
Dec. 1970 38 p
(Contract AT(30-1)-3699)
(NYO-3699-51) Avail: NTIS

The failure of the harmonic approximation for the lattice dynamics of solid H2, D2, He-3, and He-4 at densities corresponding to pressures below the order of 1000 atmospheres is discussed. Evidence is presented that the equation of state for solid H2, D2, He-3, He-4, and Ne-20 at high densities may be calculated successfully in the harmonic approximation. Equation of state curves at high density for H2, D2, He-3, He-4, and Ne-20 (all for the fcc phase at T = 0 K) are given and compare well with results from Monte Carlo or cluster expansion treatments using a Jastrow wave function. It is concluded that good high density computations are not critically dependent upon short range correlation effects. Author

N71-37111# California Univ., Berkeley. Lawrence Radiation Lab.
EFFECTS ON THE PROPAGATION OF OPTICAL BEAMS DUE TO SELF-INDUCED CHANGES IN INDEX OF REFRACTION
R. A. Fisher, J.-P. Taran, R. Y. Chiao, T. K. Gustafson, and P. L. Kelley Mar. 1971 52 p refs
(Contract W-7405-eng-48)
(UCRL-20541) Avail: NTIS

Some of the processes are described which occur when light beams pass through material systems which possess an intensity dependent refractive index. These effects include: self-trapping and self-focusing, intensity-dependent birefringence, four-photon scattering, and inelastic light scattering (taking into account the finite relaxation time of the induced index change), as well as self-induced distortion of the amplitude and phase of intensity-modulated plane waves (with consequent spreading in the frequency spectrum of the light). Such intensity-dependent phenomena arise from the optical Kerr effect. Neglecting relaxation effects, this directly produces a nonlinear change in the optical refractive index which is proportional to the intensity of the optical beam. Most of the effects listed above have been observed experimentally for the optical Kerr effect. A simple model of the optical Kerr effect is obtained by considering the orientation of anisotropically polarizable molecules. Author

N71-37112# National Aeronautical Establishment, Ottawa (Ontario). High Speed Aerodynamics Section.
PLANE SOUND WAVES OF FINITE AMPLITUDE IN A NON-DISSIPATIVE MEDIUM
S. H. K. Lee May 1971 27 p refs
(NRC-12146) Avail: NTIS

A theoretical treatment of plane progressive sound waves of finite amplitude in a non-dissipative medium produced by a piston whose motion contains many different frequency components is presented. The solution of the second order wave equation is represented in the form of a Fourier series and the coefficients are expressed in terms of Bessel functions. The progressive distortion of the wave form and the generation of higher harmonics are studied from consideration of the energy density of the different frequency components. Due to the nonlinearity between the pressure and specific volume, there is found to be a transfer of energy from components of lower frequency to those of higher frequency. This transfer of energy is more efficient if harmonics are initially present in the sound wave. Author

N71-37113# Defence Research Establishment Toronto, Downsview (Ontario).
NOISE SURVEY: A TURBOSHAFT POWER PLANT COUPLED TO A MOBILE TEST BED
R. A. Stong Mar. 1971 7 p refs
(DRET-TM-768) Avail: NTIS

Measurements were made of the overall sound pressure levels and spectra of the noise generated by a turboshaft power plant coupled to a mobile engine test trailer and operated outdoors. Running at maximum power the system produced overall sound pressure levels as high as 125 dB with the significant sound energy distributed between 300 and 8000 Hz, equivalent to an ISO noise hazard rating of 125. Author

N71-37114# Naval Research Lab., Washington, D.C.
A SPATIAL FREQUENCY TECHNIQUE FOR IMAGING AND REMOTE GAUGING Final Report
Jerry A. Blodgett Jul. 1971 16 p refs
(AD-726683; NRL-MR-2280) Avail: NTIS CSCL 17/8

A technique for obtaining the spatial frequency spectrum of the cross section of an image is examined and its limitations are discussed. The technique employs a rotating radial grating on which a slit selected portion of an image of the object is projected. The intensity of the image transmitted by the grating is collected and measured by a photodetector. It is shown that the frequency components of the detector signal are directly related to the spatial frequency components of the image and that the resolution in the reconstructed image depends on the number of harmonics measured and the accuracy of the measurement. The effects of the other factors on the implementation of this technique are also discussed. Author (GRA)

N71-37115# European Space Research Inst., Frascati (Italy).
ABSENCE OF GRAVITATIONAL SCINTILLATION
Bruno Bertotti and Dario Trevese 1971 10 p refs Submitted for publication
Avail: NTIS

The effect of gravitational waves on electromagnetic propagation in the physical optics approximation is studied. It was found that, owing to the transversal character of the former, this effect has a local character (i.e., it does not increase with the distance travelled). Nonlocal perturbations might occur if the gravitational waves had a longitudinal component; but even in this case the effect is negligible, due to the fact that both fields propagate with the same speed. Author (ESRO)

N71-37116# European Space Research Inst., Frascati (Italy).
NOTE ON THE PROPAGATION OF GRAVITY WAVES IN THE PRESENCE OF TEMPERATURE GRADIENTS, WIND SHEARS, AND MAGNETIC FIELDS
James F. McKenzie 1971 28 p refs Submitted for publication
Avail: NTIS

The general equations for small, atmospheric motions under the combined effects of compressibility, gravity, and magnetic fields are presented. The properties of acoustic gravity waves and hydromagnetic waves are also reviewed. The effects of temperature gradients and wind shear on the propagation of a gravity wave ray are investigated, along with acoustic wave behavior. The modification of gravity wave propagation is studied in a magnetic field in incompressible approximation. Low altitude gravity wave motions were found to be trapped in the tropido ionosphere like Alfven waves. ESRO

N71-37117# Southampton Univ. (England). Inst. of Sound and Vibration Research.
THE LOUDNESS OF TRANSIENT SOUNDS: A FIELD EXPERIMENT AT MEPPEN Interim Report
David B. Fleming Jan. 1971 66 p refs Sponsored by Ministry of Aviation Supply
(TR-42) Avail: NTIS

Data are given on the generation and propagation of transient sounds including sonic booms, tank guns, explosive charges, and sonic boom simulations and the effects of these sounds on structures. The method of magnitude estimation was used to assign the intensity of the sounds as heard by different subjects. These estimations were compared with readings obtained from the loudness meter. A systematic difference was observed and was believed to be caused by the difference between the nonlinear frequency weighting function used in the calculation, and the linear function used in the meter. E.H.W.

N71-37118# Stanford Research Inst., Menlo Park, Calif.
NUMERICAL CALCULATION OF THE NEAR FIELD FOR SPHERICALLY SYMMETRIC NONLINEAR ACOUSTIC FLOWS IN AN UNBOUNDED IDEAL GAS Technical Report, 1 Jun. 1967 - 31 Jan. 1970
George M. Muller Wright-Patterson AFB, Ohio AMRL 1 Apr. 1971 187 p refs
(Contract F33615-67-C-1751)
(AD-727012; AMRL-TR-70-66) Avail: NTIS CSCL 20/1

An implicit finite-difference method has been developed for calculating spherically symmetric nonlinear acoustic flows generated by a high-intensity periodic source. This method makes it possible to match the conditions prescribed at the source to a low-amplitude solution (in Blackstock's sense) valid at large distances from the source. Numerical computations have been made for piston-like and siren-like sources of three different periods and several source amplitudes. Extensive graphs of the results are presented in this report, together with estimates of the errors associated with the method of computation. The numerical results have also been used to show that, in some instances, a low-amplitude solution may be matched directly to a given source even though the conditions for validity of that solution are not satisfied near the source. Author (GRA)

N71-37119*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FLOW RESISTANCE OF PERFORATED PLATES IN TANGENTIAL FLOW
Marvin Budoff (George Washington Univ., Washington, D. C.) and William E. Zorumski Washington Oct. 1971 12 p refs
(NASA-TM-X-2361; L-7874) Avail: NTIS CSCL 20D

Investigated were changes in flow resistance of perforated plates resulting from varying the tangential flow across the plate surface, the direction and magnitude of normal flow through the plate, and the number of holes in the plate, keeping the open area constant. As expected, flow resistance increased with increases in tangential and normal flow. A discontinuity in flow resistance was found when the direction of normal flow was reversed. At higher tangential-flow Mach numbers the flow resistance decreased as the number of holes in the plate increased and hole size decreased. Author

N71-37120# Houston Univ., Tex.
ELECTROMAGNETIC INDUCTION OF ROTATING MAGNETS
Thomas Nai-Chen Tsien (Ph.D. Thesis) 1970 81 p refs
Avail: NTIS

A modified unipolar machine has been studied where the rotor consists of two parallel magnets embedded in a superconducting lead casting. The voltage detection circuit is well shielded with superconducting materials and is assured to be in zero magnetic field and insulated from the magnets. The same steady voltages as observed for the ordinary unipolar generator are measured on rotating the magnets inside a soft iron cylindrical shell at 4.2 K. The results disagree with the conventional calculations but can be explained due to the rotation of the magnets. The strength of the rotating magnets at any time has been calculated by treating each magnet as if it were at rest with respect to the circuit. As time passes on, the rotating magnets undergo different orientations to give different values at the circuit and the resulting change induces the observed e.m.f. The analysis has been extended to show that the unipolar voltage is basically the result of an induction effect, provided the motion of the magnetic sources are followed.
Author

N71-37121# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
STIMULATED LIGHT SCATTERING IN BINARY GAS MIXTURES Quarterly Technical Report, period ending 27 Jun. 1971
N. Bloembergen and H. Lowdermilk Jun. 1971 180 p refs
(Contract DAHC04-68-C-0037; ARPA Order 875-7)
(AD-726469; TR-2) Avail: NTIS CSCL 20/6

The theory of stimulated light scattering from a binary gas mixture was developed. It considers the coupling of a laser wave and a scattered light wave with the collective modes of the mixture. It was found that in a binary gas mixture in which the different types of molecules have a large difference in mass and polarizibility, it is possible to generate stimulated scattering from local fluctuations in the concentration. The shift in frequency between the laser and backward scattered wave was observed systematically as a function of helium concentration from 0 to 90% in mixtures of He and SF6 in which the partial pressure of SF6 was 5 atm., and in mixtures of He and Xe in which the partial pressure of Xe was 8 atm. In both cases, for helium concentration less than 60% the frequency shift of the backscattered light is characteristic of stimulated Brillouin scattering in the mixture. As the helium concentration increases above 60%, the frequency shift decreases and rapidly approaches the small values which are characteristic of stimulated concentration scattering. The experimental observations are in good agreement with theoretical predictions. Author (GRA)

N71-37122# Lockheed Missiles and Space Co., Palo Alto, Calif.
THERMAL NOISE IN QUASISTATIONARY LOOPS. FLUCTUATION-DISSIPATION THEOREM
S. M. Rytov [1966] 10 p refs Transl. into ENGLISH from the book "Vvedenie v Statisticheskuiu Radiofiziku" Moscow, Nauka, 1966 p 285-295
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616 CSCL 20M

Electrical fluctuations of thermal origin in charge, current, and voltage for quasi-stationary circuits were studied. Using the Nyquest formula in combination with the Kirchoff equations in a system with thermodynamic equilibrium, it is shown that the systems which do not have an active resistance do not contain a thermal noise source. F.O.S.

N71-37123# National Bureau of Standards, Boulder, Colo. Time and Frequency Div.
TIME AND FREQUENCY: A BIBLIOGRAPHY OF NBS LITERATURE, JULY 1965 - DECEMBER 1970
B. E. Blair Jun. 1971 53 p
(NBS-SP-350) Avail: SOD $0.55

Bibliographic references are given to NBS time and frequency papers published over the past 15 years. The NBS material is classified under five general sections: time and frequency standards; time scales, time; distribution/reception of time and frequency signals; statistics of time and frequency analyses, frequency stability; and general, summary, and status reports. An additional section lists outside publications which describe the use of NBS time and frequency services or illustrate their varied use in seismic research, industrial practice, navigation, and propagation studies, among others. Author

N71-37124# National Bureau of Standards, Washington, D.C. Heat Div.
EFFECT OF CERAMIC SPECTRAL EMISSIVITY VARIATIONS ON THE COMPUTED LUMINOUS EMISSIVITY OF THE NBS STANDARD OF LIGHT
William B. Fussell Sep. 1971 57 p refs
(NBS-TN-595) Avail: SOD $0.65

A simplified model for the standard of light (platinum point blackbody) is introduced. This model is used to calculate the apparent luminous emissivity of the base of the sighttube of the standard of light, and of the wall near the base, by two different methods. The first method includes the effect of variations with wavelength in the spectral emissivity of the ceramic composing the sighttube; the second method does not include the effect of ceramic spectral emissivity variations. The results of the two methods are compared and their difference is found to be negligible for the design when the sighttube is made of alumina, compared with other uncertainties and the precision of measurement. A formula is derived for estimating the apparent luminous emissivity of the standard of light. Author

N71-37125 National Lending Library for Science and Technology, Boston Spa (England).
THE STROBOSCOPIC EFFECT UNDER CONDITIONS OF ILLUMINATIONS BY GAS-DISCHARGE LIGHT SOURCES
Yu. I. Sviridov 10 Mar. 1971 10 p refs Transl. into ENGLISH from Svetotekhnika (Moscow), v. 15, no. 8, Aug. 1969 p 8-10
(NLL-OA-Trans-1071-(6193.3)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The flicker from gas discharge light sources used in industrial lighting installations is investigated as a source of stroboscopic formation in the presence of moving or rotating objects. Specifications to limit the extent of luminous flux fluctuations in such light sources are discussed. Measurements were made in an insulated chamber. Results indicate that: (1) an increase of the photometric contrast of the object with the background causes the formation of the stroboscopic effect with smaller values of the flicker coefficient,(2) the wave shape of the flickering luminous flux, inherent with gas discharge light sources, has practically no effect on the conditions of stroboscopic effect formation, and (3) the experimental data and the theoretical considerations, with a known photometric contrast of the object and the background, allow the values of K sub p at which the stroboscopic effect is eliminated to be established with a given probability. E.H.W.

N71-37126 National Lending Library for Science and Technology, Boston Spa (England).
EDDY CURRENT LOSSES CAUSED BY RAPIDLY VARYING MAGNETIC FIELDS
S. Oswald Feb. 1971 11 p Transl. into ENGLISH of Inst. fuer Plasmaphys. Report IPP4/80, Sep. 1970
(NLL-CTO/754-(9091.9F); IPP-4/80) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The eddy current losses in closed current loops caused by pulsed magnetic fields are calculated. The results may be useful for various applications, such as pulsed magnets and superconducting coils. Author

N71-37127 National Lending Library for Science and Technology, Boston Spa (England).
THE RELATIONSHIP PULSE BETWEEN PULSE LOUDNESS, ENVELOPE SHAPE AND SPECTRUM
K. Notbohm Apr. 1970 26 p refs Transl. into ENGLISH from Hochfrequenztech. U. Elektroakust. (Leipzig), v. 79, no. 2, Apr. 1970 p 65-74
(NLL-Trans-2713-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 3 NLL photocopy coupons

Loudness comparisons were made using the production method between pulses of sinusoidal tone having different envelope shapes. The test tones used were exponential, triangular, half sine wave and sine squared tones, whereas the comparative noise was a rectangular tone giving the same subjective impression of tone duration. All tests were made with a fundamental frequency and at a loudness level of about 70 phon. The results were compared with theoretical curves for the pulse sound level based on the assumption of an energy time constant. Agreement was found within the limits of experimental error. This again shows that human hearing can be adequately simulated overall by means of a simple energy storage link and that for the loudness level of narrow band noises, the peak value of the inertia-weighted sound energy is determinative together with the effects of frequency. Author

N71-37128 Utah Univ., Salt Lake City.
INTERACTIONS OF INTENSE COHERENT LIGHT WITH IODINE VAPOR, NEODYMIUM-DOPED GLASS, AND BENZENE
Lorin W. Brown (Ph.D. Thesis) 1970 106 p
Avail: Univ. Microfilms Order No. 70-19077

A new stimulated effect was observed in benzene. Broadband stimulated emission in the region of 9100A to 10,900A was observed when the benzene was pumped with light at 6943A from a ruby Q-switched laser. The emission consisted of a pulse of less than 10 nsec duration. Peak power of the pulse was approximately 500 kW when the ruby laser output was 40 MW. Threshold was estimated at 25 + or - 10 MW/sq cm. Stimulated emission at 1.06 microns was observed from neodymium-doped glass when it was pumped with Raman-shifted light at 7458A, 8063A, and 9751A. The Raman-shifted light was obtained by passing light from a Q-switched ruby laser through benzene. The emission consisted of a pulse of less than 10 nsec duration. Absorption of laser radiation at 6943A and 5310A was measured in iodine vapor but no stimulated effects were apparent. Dissert. Abstr.

N71-37129 California Univ., Berkeley.
EMISSIVITIES OF METALS AT CRYOGENIC TEMPERATURES
Bassem Farid Armaly (Ph.D. Thesis) 1969 66 p
Avail: Univ. Microfilms Order No. 70-17498

The total hemispherical emissivity of thin metallic films was measured in the temperature range of 200 K to 300 K. The effect of film thickness on this property was also determined analytically. The various methods used to evaluate the properties of thin metallic films were evaluated and compared with an exact numerical solution taking both the size effect and the anomalous skin effect into account. An analysis based on the ASE theory for predicting the thermal radiation properties of thin metallic films is presented. The spectral normal emissivity as a function of temperature, wavelength, and film thickness was calculated. The approximate methods show the same trends as the exact numerical solution, however, they fail to predict as high a value for the emissivity. The measurements of the total hemispherical emittance for two gold films 400 A and 2500 A thick, are also presented. The observed effect of the film thickness on this property agrees with the analytical solution. Dissert. Abstr.

N71-37130 California Univ., Berkeley.
RADIATION IMPEDANCE FUNCTIONS OF RECTANGULAR PISTONS AND THEIR APPLICATION TO SOUND TRANSMISSION THROUGH FINITE DEPTH APERTURES
David Storer Burnett (Ph.D. Thesis) 1969 181 p
Avail: Univ. Microfilms Order No. 70-17518

The radiation impedance functions for a rigid rectangular piston radiating from a rigid infinite baffle into a half-space are calculated to 7D accuracy over 3 decades of (dimensionless) frequency and a wide range of aspect ratio (ratio of length to width of rectangle). Each impedance value requires the evaluation of two integrals with highly oscillatory integrands. A special numerical quadrature technique is developed which yields an extremely fast and accurate computer algorithm: approximately seven thousand highly oscillatory integrals are evaluated in 2 minutes, each to 7D accuracy, on a CDC 6400 computer. Tables for aspect ratios 1,2,4,8,16 and 32 are contained in the appendix. An asymptotic series extends these tables indefinitely at the high frequencies. These radiation impedance functions are then used to calculate the sound transmission loss through finite depth rectangular apertures with the above aspect ratios. Dissert. Abstr.

N71-37131 California Univ., Berkeley.
STUDIES IN THE ROTATION AND LORENTZ SYMMETRIES OF SCATTERING AMPLITUDES
Kuo-hsiang Wang (Ph.D. Thesis) 1969 122 p
Avail: Univ. Microfilms Order No. 70-17681

A general study of the space-time symmetries of the scattering amplitude is made. The scattering amplitude in the c.m. frame has O(2,1) symmetry in the physical regions of the crossed channels. By working in this frame, the same definition of the helicity can be used as that used in the usual angular momentum analysis. For the pairwise equal mass case the helicity amplitude in the forward scattering region of the crossed channels has O(2,2) symmetry in the c.m. frame, and O(3,1) symmetry in the brick wall frame. An O(2,2) expansion to a multiparticle system is applied. The O(4) expansion in the brick

wall frame is continued into the O(3,1) region, and the equivalence between the O(4) expansion and the O(3,1) expansion is shown. Finally, the difference is pointed out between the implications of the three-dimensional and four-dimensional symmetries. In a second study, the Clebsch-Gordan series of the O(2,1) group and its covering group SU(1,1) for all cases except that of the supplemental series are derived. The applications to the unitary irreducible representation of O(2,2) are also studied. Dissert. Abstr.

N71-36786*# Centre National d'Etudes des Telecommunications, Lannion (France).
TECHNIQUES OF ANALYZING ACCELERATION [LA TECHNIQUE DES ESSAIS ACCELERES]
P. Blanquart *In* AGARD Reliability of Avionics Systems Jul. 1971 18 p In FRENCH (See N71-36776 23-14)
Avail: NTIS

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N71-37132# Paris Univ. (France). Faculte des Sciences.
STUDY OF HIGH ENERGY PION NUCLEON BACKWARD SCATTERING: MEASURING OF THE PION (MINUS) PROTON YIELDS NEUTRON PION (0) DIFFERENTIAL CROSS SECTION AND BARYON EXCHANGE MODEL WITH ABSORPTION SPECTRA [ETUDE DES DIFFUSIONS PION NUCLEON VERS L'ARRIERE A HAUTE ENERGIE: MESURE DE LA SECTION EFFICACE DIFFERENTIELLE POUR PION(MINUS) PROTON YIELDS NEUTRON PION(0) ET MODELE D'ECHANGE DE BARYONS AVEC ABSORPTION]
Jean Schneider (Ph.D. Thesis) 1971 62 p refs In FRENCH
(NP-18840; CNRS-AO-5390) Avail: AEC Depository Libraries

Backward pion nucleon scattering reactions were studied from a measurement of the differential cross section of the charge exchange reaction pion(-) proton yields pion(0) neutron. The originality of the experimental method concerns the photograph analysis: a relation was established between the energy of the gamma photon emitted and the number of sparks produced in the spark chamber. The contamination due to unwanted neutral pions was estimated at 4 GeV/c, 6 GeV/c, 8 GeV/c, and 11 GeV/c. The results obtained were reinserted into the backward pion nucleon scattering model using a kinematic reconstitution and a Monte Carlo simulation. A Regge pole model with absorption was used, in which the three nucleon alpha, nucleon photon, and Delta hyperon trajectories intervene. The absorption phenomena which occur, explain why the differential cross section of the pion(-) proton yields proton pion(-) reaction does not present a minimum for the cancellation of the Delta hyperon trajectory signature (-1, 8 GeV/sq c transfer). A maximum polarization is predicted at -7 GeV/sq c. NSA

N71-37133# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
PROGRAMS FOR THE MANAGEMENT AND PROCESSING OF NEUTRON DIFFRACTION DATA
Margaret M. Elcombe, G. W. Cox, A. W. Pryor, and F. H. Moore Feb. 1971 56 p
(AAEC/TM-578) Avail: AEC Depository Libraries

The programs developed for the processing of crystallographic data from manual and computer-controlled diffractometers are described. The description, theory, and input and output formats are given, but not the program listings. The programs for handling, editing, and reducing the 5-hole tape produced by manually operated machines is described, also the revised versions of the programs associated with the computer-controlled diffractometers. The programs for sorting, absorption-correcting, evaluating standard deviations and job-control procedures are detailed. Author (NSA)

N71-37134# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
DEPOLARIZATION IN 612 MeV ELASTIC pn-SCATTERING
L. N. Glonti, Yu. M. Kazarinov, and M. R. Khaystov 1971 25 p refs In RUSSIAN; ENGLISH summary
(JINR-P1-5743) Avail: AEC Depository Libraries

Depolarization in 612-MeV elastic pn-scattering was measured to fill in the lack of experimental data in the pn-system necessary for the unambiguous determination of the 600 to 650 MeV nucleon-nucleon scattering amplitude. The experimental set up permitted measurements at two angles. The proton beam extracted from the accelerator was scattered on carbon at 6.3 deg. The obtained polarized beam with the 0.332 + or - 0.011 polarization underwent second scattering on deuteron neutrons (the difference effect of CD2 and hydrogen was measured). The events of quasi-elastic pn-interactions were determined by the C1 + C2 + C3 - AC and C1' + C2' + C3' - AC' for two scattering angles, respectively, by means of fast coincidence-anti-coincidence circuits. The third analyzing scattering on carbon occurred in spark chambers. The pn-event selection was regulated by means of small spark chambers. The measurements were performed with four combinations of the first and second scattering to reject systematic errors. Author (NSA)

N71-37135# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics.
NEUTRON-ELECTRON INTERACTION STUDIED BY NEUTRON DIFFRACTION ON A SINGLE CRYSTAL OF W-186
Yu. A. Alexandrov 1971 19 p refs
(JINR-E3-5713) Avail: AEC Depository Libraries

Experiments performed on the study of n(+)e scattering by neutron diffraction on a single crystal of W-186, whose nuclear scattering amplitude is very small, are analyzed and summarized. Subsequent results obtained at the fast pulsed reactor in Dubna are presented. Some perspectives on future research on the n(+)e interaction are considered. Author (NSA)

N71-37136# European Organization for Nuclear Research, Geneva (Switzerland).
SEARCH FOR ELEMENTARY PARTICLES BEARING A MAGNETIC CHARGE: AN EXPERIMENTAL DESIGN IN THE FORM OF A MODIFIED VARIANT
M. I. Blagov et al Mar. 1971 23 p refs Transl. into ENGLISH of Akad. Nauk SSSR, Inst. Fiz., Moscow, report, Rept-46
(CERN-Trans-71-10; Rept-46) Avail: AEC Depository Libraries

An experiment is proposed for the study of a range of possible monopole charges from 1 e to 70 e in a mass range from 4.8 downwards. The statement of the problem, behavioral characteristics of monopoles with a large charge used in well known experiments for their detection, identification of monopoles with small charges, general description of the experiment, overcoming the background, the recording apparatus, and the expected results are discussed. NSA

N71-37137# Lyon Univ. (France). Institut de Physique Nucleaire.
REACTIONS (d,alpha) WITH Fe-54 AND V-51
Jean-Yves Grossiord (Ph.D. Thesis) Dec. 1970 86 p refs In FRENCH
(LYCEN-7087) Avail: AEC Depository Libraries

The two-nucleon transfer reactions Fe-54(d,alpha)Mn-52 and V-51(d,alpha)Ti-49, produced by 28 MeV incident deuterons, were studied. The excitation spectra and the angular distributions

of the levels of Mn-52 and Ti-49 were established. The experimental results are analyzed in the framework of the shell model with independent particles. The shape of the angular distributions depends upon the well depth in the alpha channel, and characterizes the transferred angular momentum L for a transfer occurring in the same shell. For a target nucleus with zero spin (Fe-54) the spin of the final state in the residual nucleus can be determined when the restriction J = L or J = L + 1 is imposed. The results obtained for Mn-52 and Ti-49 are compared with those obtained by other workers for the same nuclei by means of different reactions. The spin and parity of some already known levels are confirmed. NSA

N71-37138# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics.
EFFECT OF THE OPTICAL PARAMETERS OF THE MEDIUM ON THE YIELDS OF TRANSITION RADIATION OF NON-RELATIVISTIC PARTICLES
A. P. Kobzev, S. Michalak, J. Rutkowski, and I. M. Frank 1971 16 p ref In RUSSIAN
(JINR-P4-5734) Avail: AEC Depository Libraries

The effect of the values of real and imaginary parts of the refraction index on the yield and angular distribution of the transition radiation of nonrelativistic charged particles is considered. Author (NSA)

N71-37139# Academy of Sciences (USSR), Moscow. Inst. Atomnoi Energii.
MEASUREMENTS OF ANGULAR CORRELATION OF NEUTRON SPIN AND ANTINEUTRINO MOMENTUM IN THE DECAY OF POLARIZED NEUTRONS
B. G. Erozolimskii, L. N. Bondarenko, Yu. A. Mostovoi et al 1970 16 p refs In RUSSIAN
(IAE-1947) Avail: AEC Depository Libraries

The magnitude of the B-constant between vectors of neutron spin and antineutrino momentum in beta decay of polarized neutrons was measured. The magnitude B obtained was equal to 0.995 + or -0.34 and was found within the limits of one standard error of measuring at the magnitude 0.99 predicted by V-A-variation of the weak interaction theory. NSA

N71-37140# Commissariat a l'Energie Atomique, Fontenay-Aux-Roses (France). Centre d'Etudes Nucleaires.
RESEARCH OF A BIASING SYSTEM FOR THE TREATMENT OF THE DEEP PENETRATION OF NEUTRONS BY THE MONTE CARLO METHOD
Jeanne-Marie Lanore (Ph.D. Thesis - Paris Univ.) Jan. 1971 73 p refs In FRENCH
(CEA-R-4148) Avail: AEC Depository Libraries

The Monte-Carlo method can be successfully applied to the study of the deep penetration of neutrons, by means of a biasing system using an asymptotic solution of the adjoint transport equation as an importance function. This system enabled a reduced and constant variance at every point in a phase space, which was rigorous in a special case and almost rigorous in the general case, to be obtained. Neutron spectra at a very great distance from the source were thus accurately derived, and an absolute upper limit of the variance could be calculated.
Author (NSA)

N71-37141# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Institut Fiziki Vysokikh Energii.
INCREASE OF THE EFFECTIVENESS OF SYNCHRONIZED CAPTURE DURING BUNCHING OF THE BEAM OUTSIDE THE SEPARATRIX [UVELICHENIE EFFEKTIVNOSTI SINKMROTRONNOGO ZAKHVATA PRI GRUPPIROVKE PUCHKA VNE SEPARATRISY]
G. G. Gurov, E. A. Mysa, P. T. Pashkov, and K. A. Yakovlev 1970 18 p refs In RUSSIAN
(IFVE-SKU-70-20) Avail: AEC Depository Libraries

The results of the calculation on the analog computer of a capture factor of particles into a synchrotron acceleration process for the case of preliminary bunching of the beam out of a bucket are given. The beam energy spread was taken into account in the calculations which were carried out for the 70 GeV IHEP PS. The cases of particle injection above the bucket as well as below it were treated. The experimental data on the trapping efficiency growth, which in principle agree with the calculation, are given. The experimental methods are described. Author (NSA)

N71-37142# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
PARTIAL ELIMINATION OF INFRARED DIVERGENCES IN THE MODEL OF QUANTUM FIELD THEORY WITH DEGENERATED VACUUM
L. G. Zastavenko 1971 16 p refs In RUSSIAN
(JINR-P2-5760) Avail: AEC Depository Libraries

The model of a scalar charged field with self-action in two-dimensional space-time is considered for the case when the vacuum is degenerated. In the quantum field theory with degenerated vacuum the particles with zero rest mass are necessarily present which induce the appearance of infrared divergences. It is shown that taking account of some class of diagrams together with each divergent diagram determining this class leads to annihilation of the divergences in the expressions for mean values; in this case in the expansion over small parameter 1/beta there appear nonanalytical terms approximately in beta/beta when 1/beta = 0. Author (NSA)

N71-37143# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
CONFORMAL-COVARIANT INTERACTIONS
E. A. Tagirov 1971 16 p refs In RUSSIAN Presented at 2d Intern. Conf. on Linear and Nonlocal Quantum Field Theory, Dubna, USSR, 15-25 Mar. 1970
(JINR-P2-5716; Conf-700342-1) Avail: AEC Depository Libraries

Necessity and consequences of approximate conformal covariance of field equations are considered. A connection between conformal covariance and gauge invariance of interactions is established. Author (NSA)

N71-37144# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
FUNCTIONAL INTEGRATION AND REGGE-EIKONAL REPRESENTATION OF THE SCATTERING AMPLITUDE
B. M. Barbashov and V. V. Nesterenko 1971 14 p refs In RUSSIAN
(JINR-P2-5768) Avail: AEC Depository Libraries

In scalar model for g psi-2 phi, by the functional integration method in the straight-line approximation, the Regge-eikonal representation was obtained for the amplitude of high-energy particle scattering. All kinds of ladder diagrams with the multi-tower exchange were summed within the given approximation. Author (NSA)

N71-37145# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
RELATIVISTIC THREE-PARTICLE PROBLEM IN TERMS OF THREE-DIMENSIONAL VARIABLES
A. N. Kvinikhidze and D. Ts. Stoyanov 1971 27 p refs
(JINR-E2-5771) Avail: AEC Depository Libraries

Using the retarded part of the two-time Green function of three particles, the equations determining the relativistic scattering amplitudes of all possible (1|6) transitions in a three-body system are obtained. The equations do not contain the relative energies and are the relativistic generalization of the Faddeev equations. The equations for the wave functions of a three-particle bound state are also derived. Author (NSA)

N71-37146# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
THE STUDY OF SPIN EFFECTS AT HIGH ENERGY IN

THE QUASIPOTENTIAL APPROACH
V. R. Garsevanishvili, S. V. Goloskokov, V. A. Matveev, and L. A. Slepchenko 1971 15 p refs
(JINR-E2-5770) Avail: AEC Depository Libraries

Meson-nucleon scattering at high energies was considered in the quasipotential approach. For the scattering amplitude a representation of the eikonal type was obtained. The corrections of the relative order 1/p as compared to the leading contributions were calculated. Author (NSA)

N71-37147# Academy of Sciences (USSR), Moscow. Inst. Atomnoi Energii.
LEPTON DECAY OF THE HYPERNUCLEUS H-3
V. A. Lyulka 1970 15 p refs In RUSSIAN
(IAE-1944) Avail: AEC Depository Libraries

Lepton decays for the hypertriton were studied. Recoil spectra of He-3 and angular lepton-neutrino correlation in the decays of hypertriton yields He-3 + lepton + antineutrino were estimated. Calculations were made of the longitudinal and transverse polarization in the plane of the muon decay. The lifetime of the decays was determined. A brief analysis was also made of the leptonic decays of hypertritons into four particles. NSA

N71-37148# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Lab. Nazionali di Frascatti.
POSITRON-ELECTRON ANNIHILATION INTO HADRONS IN THE PREASYMPTOTIC REGION AND MUON(PLUS) MUON(MINUS) PRODUCTION IN PROTON COLLISIONS
G. Parisi 3 Feb. 1971 4 p refs
(LNF-71/5) Avail: AEC Depository Libraries

Parton model predictions are compared with the Adone data. The relevance of the parton antiparton threshold is stressed and a simple explanation is given for the structure recently observed in the production of high mass muon(+)muon(-) pairs in proton collisions. Author (NSA)

N71-37149# Institute of Nuclear Research, Warsaw (Poland).
AFST MODEL WITH PION PION AND PION PROTON PHASE SHIFTS AND DURR-PILKUHN FORM FACTORS APPLIED TO THE REACTION PION(PLUS)PROTON YIELDS PROTON 3 PION(PLUS)2 PION(MINUS) AT 8 GeV/c
A. Jurewicz, L. Michejda, J. Namyslowski, and J. Tumau 1971 58 p refs
(INR-P-1265) Avail: AEC Depository Libraries

A multiperipheral model is used to perform calculations without any essential approximation for one definite channel pion(+) + p yields 3 pion(+) + 2 pion(-) + p and one definite energy 8 GeV/c, for which the chosen channel represents about the average multiplicity. This numerical calculation was performed with pion pion and pion proton phase shifts and the off-shell extrapolation for the studied reaction. Only pion exchange was considered. NSA

N71-37150# Atomic Energy Establishment, Cairo (Egypt). Reactor and Neutron Physics Dept.
RAM-1, MULTIGROUP NEUTRON DIFFUSION CODE FOR THE IBM-1130
S. F. Nassar and M. M. Abu-Lailah 1970 21 p refs
(UARAEE-107) Avail: AEC Depository Libraries

The code RAM-1, for solving the time-independent neutron diffusion problem, is written in a FORTRAN language for the IBM-1130 data processing system. The code is memory-contained and requires no tapes. It can handle up to 11 energy groups, four different regions, and 55 spatial mesh points. Among its features are high-order differencing of the differential equation, a power extrapolation technique, and an energy-dependent extrapolation-length boundary condition at the outer boundary. The code was tested on two fast reactor assemblies. The first was ZPR-3 cylindrical type reactor; the second was EBR-2 spherical type reactor. The results were in excellent agreement with those already reported in literature. Author (NSA)

N71-37151# Atomic Energy Establishment, Cairo (Egypt). Reactor and Neutron Physics Dept.
THERMAL NEUTRON CAPTURE GAMMA RAYS IN IRON
A. M. Hassan, H. M. Abu-Zeid, and I. Hamouda 1970 19 p refs
(UARAEE-103) Avail: AEC Depository Libraries

Thermal neutron capture gamma radiation from natural iron sample was investigated with the aid of a three-crystal scintillation pair spectrometer. Previously unreported lines in natural iron of energies 6.95, 6.75, 5.35, and 5.18 MeV were observed. Author (NSA)

N71-37152# Institute of Nuclear Techniques, Krakow (Poland).
ESTIMATION OF ENERGY AND MEAN INELASTICITY OF NUCLEAR INTERACTIONS AT ENERGIES ABOVE 3 X 10 TO THE 12TH POWER eV USING A SIMPLIFIED VERSION OF IONIZATION SPECTROMETER
Jerzy Masselski, Leszek Suszycki, and Jerzy Warczewski Nov. 1970 25 p refs
(ITJ-3) Avail: AEC Depository Libraries

An analysis of 111 events obtained at the mountain laboratory on Mount Aragac was performed using a Monte Carlo method for simulating nuclear-electromagnetic cascades. Using a digital computer 1036 simulated events were obtained. A method for determination of the energy of high energy particles using a simplified version of ionization spectrometers was worked out. The energy spectrum of individual nuclear active particles at the altitude of Mount Aragac was determined. The exponent of the spectrum was found to be gamma = 2.0 + 0.2 or - 0.3. The flux of the particles was I(> 3 TeV) = (1.8 + or - 0.6) x 10 to the minus 9th power/sq cm/s/sr. The mean inelasticity coefficients for nucleon collisions with lead and graphite nuclei were 0.7 + or - 0.1 and 0.5 + or - 0.1, respectively. Author (NSA)

N71-37153# Institute of Nuclear Techniques, Krakow (Poland).
MONTE CARLO SIMULATION OF THE NUCLEAR-ELECTROMAGNETIC CASCADE DEVELOPING IN AN IONIZATION SPECTROMETER
J. Masselski, L. Suszycki, and J. Warczewski Dec. 1970 26 p refs
(ITJ-6) Avail: AEC Depository Libraries

The calculations were performed for 830 cascades with an average energy approximately 4 TeV using various values of inelasticity coefficients. The energy balance and the total ionization as a function of depth were obtained. It was found that nuclear disintegrations and the ionization by positive or negative pions contribute significantly to the total ionization. An experimental method for the determination of the energy of the primary hadron by ionization sampling is discussed. The effect of nuclear disintegrations is found to induce underestimation of the energy of about 29% whereas statistical fluctuations introduce an error of about 8%. Author (NSA)

N71-37154# Institute of Nuclear Techniques, Krakow (Poland).
DISTRIBUTIONS AND MEAN VALUES OF INELASTICITY COEFFICIENT K FOR NEUTRAL PIONS FOR LEAD AND GRAPHITE
Jerzy Masselski, Leszek Suszycki, and Jerzy Warczewski Nov. 1970 11 p refs
(ITJ-5) Avail: AEC Depository Libraries

An analysis of the experimental material obtained in the mountain laboratory on Mount Aragac is performed using a digital computer. Distributions and mean values of inelasticity coefficient for the production of neutral pions for lead and graphite are obtained. It is found that large energy transfer to neutral pions occurs, at most, in 6% of all interactions. Author (NSA)

N71-37158# Reilly Translations, Los Angeles, Calif.
ELECTRON-ION BUNCH DIAGNOSTICS BY MEANS OF BREMSSTRAHLUNG
M. L. Ivnovich et al Feb. 1971 8 p refs Transl. into ENGLISH from the Russian report JINR-P9-4850 Prepared for Calif. Univ., Berkeley. Lawrence Radiation Lab.
(UCRL-Trans-1440; JINR-P9-4850) Avail: AEC Depository Libraries

The method of accelerating heavy atoms to high energies, based on the possibility of producing electron-ion bunches which are accelerated as a whole through an external magnetic field, produces a bremsstrahlung of the electrons during the capture process. The use of this bremsstrahlung for the diagnosis of the electron-ion bunch was investigated, both theoretically and experimentally. The theoretical study showed that the number of gamma quanta recorded during the capture process depends on the spectral sensitivity of the detector and the detection probability. In the experimental use of a Ge(Li) detector in the acceleration of Xe, the results showed that the capture process of Xe in bunches can be studied with the electron number N sub e approximately greater than 3 x 10 to the 12th power. NSA

N71-37159# Paris Univ., Orsay (France). Lab. de l'Accelerateur Lineaire.
COHERENT PRODUCTION ON THE NUCLEUS OF SYSTEMS WITH TWO, THREE, FOUR, AND FIVE MESONS BY KAON(MINUS) OF 5.5, 10, AND 12.7 GeV/c [PRODUCTION COHERENTE SUR NOYAU DE SYSTEMES A DEUX, TROIS, QUATRE ET CINQ MESONS PAR DES KAON(MINUS) DE 5.5, 10 ET 12.7 GEV/C]
B. Daugeras (Ph.D. Thesis) Feb. 1971 171 p refs In FRENCH
(LAL-1244) Avail: AEC Depository Libraries

Reactions of K(-) at 5.5 to 12.7 GeV/c with heavy nuclei in a bubble chamber are studied for the coherent production of several meson states. In particular of states decaying into pions(0) are studied. The principal results obtained in the channels analyzed are the coherent production of K(890) and Q. The K(890) is found to decay into kaon(-) pion(0) and kaon(0) pion(-), and Q decays into K* pion, K rho mesons, and K omega mesons. Cross sections for the decay of Q into K(-) pion(+) pion(-), K(0) pion(-) pion(0), and K(-) pion(0) pion(0) are also given. NSA

N71-37157# Paris Univ., Orsay (France). Acults des Sciences.
STUDY AND DEVELOPMENT OF AN INDUCTION MEASURING DEVICE FOR THE ORSAY SYNCHROCYCLOTRON [ETUDE ET REALISATION D'UN MESUREUR A INDUCTION AU S.C. D'ORSAY]
Mekram Hage-Ali (Ph.D. Thesis) 1971 42 p refs In FRENCH
(NP-18839) Avail: AEC Depository Libraries

The development of a device for measuring the induction produced by a beam of accelerated particles is discussed. The apparatus is described (supermalloy tori, a sensitive amplifier, and electronic sampling equipment). An accuracy of about 2% was obtained for mean currents in excess 3.10 x 10 to the minus 10th power amperes in a normally operating synchrocyclotron. The minimum detectable beam flux is 2.10 x 10 to the 9th power protons per second i.e. 4.10 x 10 to the 6th power protons per 20 micro-second pulse. A good stability is obtained provided the synchronization signal of the synchrocyclotron remains in phase with the extracted beam. NSA

N71-37158# Paris Univ., Orsay (France). Faculte des Sciences.
MEASUREMENT OF THE POLARIZATION PARAMETER IN HIGH-ENERGY KAON PROTON ELASTIC SCATTERING [MESURE DU PARAMETRE DE POLARISATION DANS LA DIFFUSION ELASTIQUE KAON-PROTON A HAUTE ENERGIE]
Denise Cronenberger (Ph.D. Thesis) 1970 44 p refs In FRENCH
(NP-18830; CNRS-AO-4881) Avail: AEC Depository Libraries

The polarization parameters in kaon(plus) proton and kaon(minus) proton elastic scattering were measured for energies between 6 and 18 GeV. The experiments were made using the secondary p sub 4 beam of the CERN proton synchrotron. Two targets were used, an LMN crystal (lanthanum magnesium double nitrate), and a frozen solution of a butyl alcohol in deoxygenated water, the polarization of the free protons of the targets being produced by a dynamic spin orientation process. The polarization behavior was studied and a test was made of the Regge models for kaon nucleon scattering. Inside their validity range (below 6 GeV/c). A comparison of the results and of the theoretical predictions led to a critical examination of the models. The Blackmon and Goldstein, and the Dass, Michael, and Phillips models give the best agreement with these results and with previous ones concerning the lower energy intermediate region. The agreement is not so good for the polarization in kaon proton scattering with low transfer momentum. NSA

N71-37159# Paris Univ. (France). Faculte des Sciences.
MEASUREMENT OF THE A AND R POLARIZATION PARAMETERS IN PION(MINUS) PROTON ELASTIC SCATTERING AT 6 AND 16 GeV/c [MESURE DES PARAMETRES DE POLARISATION A ET R DANS LA DIFFUSION ELASTIQUE PION(MINUS) PROTON A 6 ET GEV/C]
Bernard Amblard (Ph.D. Thesis) 1971 87 p refs In FRENCH
(NP-18873; CNRS-AO-5421) Avail: AEC Depository Libraries

The pion(minus) proton elastic scattering was studied at momenta of 6 and 16 GeV/c and at transfer momenta of -0.2 and 0.5 (GeV/c) sq. The A and R polarization parameters and the scattering amplitude terms were calculated. The results obtained for the parameters were compared with the Cohen-Tannoudji diffraction model and the Berger and Philips per Regge model. The interpretation of the results is still very difficult. NSA

N71-37160# Australian National Univ., Canberra. Research School of Physical Science.
MAGNETIC ANALYSIS OF THE REACTIONS Li7(He,d3) Be8 AND Li7(He,d)Be7
C. J. Piluso, R. H. Spear, K. W. Carter, D. C. Kean, and P. C. Barker [1969] 24 p refs
(ANU-P-520) Avail: AEC Depository Libraries

The reactions were studied at a bombarding energy of 15 MeV. Energy spectra of deuterons and tritons were measured at laboratory angles of 10 deg and 25 deg using a broad-range magnetic spectrograph. In the range of excitation energies from 0 to 18 MeV in Be-8, no evidence was found for the existence of previously unreported narrow states that are suggested by systematics and simple models. The measured position and width of the 2.9-MeV 2(+) level of Be-8 are in good agreement with values obtained previously from the reaction Be-9(p,d) Be-8, this agreement suggesting that the broad 2(+) states at higher excitation energies have little 1p-1h character. The deuteron spectra in the neighborhood of the 16.6- and 16.9-MeV levels of Be-8 show interference effects which agree well with shell-model predictions. The width of the 4.55-MeV 7/2(-) level of Be-7 was found to be (175 + or - 7) keV, which differs considerably from the previously reported value. Author (NSA)

N71-37161# Akademiya Nauk URSR, Kharkov. Fiziko-Tekhnicheskii Institut.
CROSS SECTIONS OF NUCLEAR FISSION BY PHOTONS WITH UP TO 5 GeV ENERGIES: HYPER-GIANT RESONANCES IN PHOTONUCLEAR REACTIONS
G. A. Vartapetyan, N. A. Demekhina, V. A. Kasilov, Yu. N. Ranyuk, P. V. Sorokin et al 1970 17 p refs In RUSSIAN
(KHFTI-70-27) Avail: AEC Depository Libraries

The glass-detector method was used for measuring the yield of the photofission of U-238, U-235, Th-232, Bi-209, Au-197, and Ta-181 in the photon energy range from 100 MeV to 5 GeV. Data obtained were in agreement with the yields calculated on the basis of photomeson fission model. In the photofission cross sections of U and Th, in addition to the giant resonance a

resonance takes place at photon energies approximately 300 MeV and the width near 1 GeV. Nuclear fission and integral cross sections for photofission are given in graphical form.
Author (NSA)

N71-37162# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.
ABSOLUTE, CONVECTIVE AND GLOBAL INSTABILITIES, AMPLIFICATION AND NON-TRANSMISSION OF VIBRATIONS
A. I. Akhiezer and R. V. Polovin 1970 94 p refs In RUSSIAN; ENGLISH summary
(ITF-70-96-P) Avail: AEC Depository Libraries
The review of criteria of the absolute, convective and global instability and criteria of the amplification and nontransmission of vibrations is presented. Author (NSA)

N71-37163# Atomic Energy Establishment, Cairo (Egypt). Reactors Dept.
UPWARD AND DOWNWARD SCATTERING KERNELS FOR THERMAL REACTIONS
H. Y. Foued and M. Nasr 1969 35 p refs
(UARAEE-80) Avail: AEC Depository Libraries
For nonhydrogenous moderators, the evaluation of the effective thermal cross section and the neutron flux in the thermal range involves solving an integral equation. Neutron balance is considered and, because the moderator atoms energy distribution is comparable to that of the neutrons, both upward and downward scattering are considered. The mathematical derivation of such scattering kernels is given with numerical evaluation for two cases, one for hydrogenous moderator and another for water moderator with conditions similar to that of the UAR research reactor. Author (NSA)

N71-37164# Atomic Energy Establishment, Cairo (Egypt). Reactor and Neutron Physics Dept.
NUMERICAL STUDY OF FAST NEUTRON SPECTRA IN UA-RR-1 REACTOR CORE AND REFLECTOR
R. Girgis, I. Hamouda, and G. Karchava 1969 19 p refs
(UARAEE-71) Avail: AEC Depository Libraries
The results of calculations in the core and water reflector are summarized. Leakage from the core and reflector is found with the method suggested by Perkins. The approximate Greuling-Goertzel kernel is applied to the slowing-down equation. The results are compared with those obtained with a more rigorous approach. Author (NSA)

N71-37165# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
Q VALVE DEPENDENCE OF MULTINUCLEON TRANSFER REACTIONS
Christian Toepffer 1971 10 p refs
(JINR-E2-5797) Avail: AEC Depository Libraries
The regular behavior of multinucleon transfer cross sections in reactions between heavy ions as a function of the Q values, Q(gg), for the ground state transitions is explained in the molecular wave function method. The coupled equations of the scattering problem are solved analytically. Author (NSA)

N71-37166# Atomic Energy Establishment, Cairo (Egypt). Reactor and Neutron Physics Dept.
EFFECT OF THE PROBE TUBE ON THE THERMAL NEUTRONS SPACE ENERGY DISTRIBUTION
S. El Konsol, A. Novikov, A. Hussein, and I. Hamouda 1969 52 p refs
(UARAEE-75) Avail: AEC Depository Libraries
In the measurement of the neutron space-energy distribution in a moderator by the time-of-flight method, it is usually required to extract the neutron beam through an exit tube. The exit tube influence on the neutron spectrum in this tube bottom region is considered. Using a number of simplifying assumptions about the neutron space-energy distribution at the moderator, an analytical expression is obtained for the energy dependent perturbation caused by the tube. The calculation has been carried out for the case of a black plate, immersed into an infinite water plate. The results of calculation are compared with the experimental data and satisfactory agreement is obtained.
Author (NSA)

N71-37167# United Kingdom Atomic Energy Authority, Harwell (England).
ENERGY RESOLUTION OF MULTIPLYING SEMICONDUCTOR DETECTORS FOR SOFT GAMMA SPECTROSCOPY AT ROOM TEMPERATURE
I. Ruge, G. Berg, and A. Heuberger Nov. 1970 11 p refs Transl. into ENGLISH from Nucl. Instrum. Methods (Netherlands), v. 84, 1970 p 55-60
(LB/G-3034) Avail: AEC Depository Libraries
Spectroscopy of gamma-quanta with large area silicon-detectors has a lower limit of about 40 keV at room temperature. This limit can be lowered considerably by using multiplying detectors, which amplify the signal fully but not all of the noise components. In spite of the statistical Fano-noise and two other contributions it is possible therefore to lower this limit down to about 1 keV for quantum spectroscopy. These two additional noise contributions are generated by the statistical character of the multiplication itself and by local fluctuations of the multiplication factor owing to diode inhomogeneities; their influence on the signal to noise ratio (snr) is observed to be important only for greater multiplication factors for higher gamma-energies. The individual noise contributions were measured in detail. Considering all noise components, the optimal multiplication factor was found to be about 20. For greater multiplication factors the snr decreases. Author (NSA)

N71-37168# Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Physik-Inst.
MASS SPECTROMETRIC DETERMINATION OF THE NEUTRON CAPTURE CROSS SECTION OF ISOTOPES OF THE RARE EARTHS [MASSENSPEKTROMETRISCHE BESTIMMUNG DER NEUTRONEN EINFANG-SQUERSCHNITTE VON ISOTOPEN DER SELTENEN ERDEN]
R. Dobrozemsky, F. Pichlmayer, and F. P. Viehboeck [1971] 31 p refs In GERMAN; ENGLISH summary
(SGAE-PH-104/1971) Avail: AEC Depository Libraries
For the determination of neutron-capture cross sections of rare earth isotopes, the corresponding elements were electromagnetically separated, and the highly enriched isotopes were irradiated with and without Cd shielding in the ASTRA reactor to an integrated neutron flux. Before and after irradiation the isotopic abundances were measured by mass spectrometry. The pile capture cross section, the thermal capture cross section, and the effective resonance integral for Sm-147, Sm-148, Gd-154, Gd-156, Dy-160, Dy-161, Dy-162, Dy-163, Er-166, Er-167, Yb-170, Yb-171, Yb-172, and Yb-173 were obtained.
Author (NSA)

N71-37169# Joint Inst. for Nuclear Research, Dubna (USSR).
INTERACTION OF HIGH-ENERGY RADIATION WITH MATTER
V. S. Barashenkov, N. M. Sobolevskii, and V. D. Toneev 1971 17 p refs In RUSSIAN
(JINR-P2-5719) Avail: AEC Depository Libraries
On the basis of the cascade-evaporation model of nuclear reactions a statistical (Monte Carlo) method is developed for calculating the interactions of particles having energies from several dozens of MeV to several dozens of GeV with matter. The ionization losses, meson-production processes, and pion-meson decay are taken into account. Spread of low-energy neutrons is described by means of a multigroup system of constants used in calculating nuclear reactors. The method can be applied to blocks of matter of practically any composition and configuration. The results are compared with the available

experimental data and with the published results obtained by other authors. Author (NSA)

N71-37170# Kernforschungszentrum, Karlsruhe (West Germany). Zyklotron-Lab.
IMPROVED VERSION OF TAMURA'S CODE FOR COUPLED CHANNEL CALCULATIONS: "JUPITOR KARLSRUHE VERSION"
H. Rebel and G. W. Schweimer Feb. 1971 78 p refs
(KFK-1333) Avail: AEC Depository Libraries

The coupled-channel code JUPITOR 1 was modified and improved. The most important modification is an automatic parameter search option for the best fits. The treatment of the rotational model is improved by expanding the deformed optical potential in terms of Legendre polynomials up to order 8, thereby including all terms that contribute to the excitation of the 4(+) rotational state. Coulomb excitation is included in the same manner. In the original version some programming errors occurred, which in some cases caused drastic effects on the calculated cross sections. After an adequate correction, the results agree with calculations done in the case of the rotational model by the coupled-channel program CCP1. Differences are found in some cases for the vibrational model when the original treatment of the Coulomb excitation is used. The origin of these differences was not fully clarified. A FORTRAN 4 listing of the modified code is presented. Author (NSA)

N71-37171*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COSMIC GAMMA RAYS FROM SUPRATHERMAL PROTON BREMSSTRAHLUNG
Frank C. Jones Jun. 1971 11 p refs Presented at the 12th Intern Conf. on Cosmic Rays, Hobart, Australia, 1971
(NASA-TM-X-65699; X-641-71-372) Avail: NTIS CSCL 03B

The radiation cross section for relativistic suprathermal proton bremsstrahlung has been calculated using the Weizsacker - Williams method. The method which is the natural one to use for this process, is briefly discussed and its relationship to the history of cosmic-ray research is mentioned. Curves representing the radiation spectra for protons of various energies are shown and an approximate expression for the spectrum, valid for photon energies greater than a few MeV, is given. This approximate spectrum is of the form such that the general analysis may be applied. This analysis shows that an inverse power law spectrum of protons will produce, via the suprathermal proton bremsstrahlung process, an inverse power law spectrum of gamma rays that is one power steeper than that of the protons. This makes it quite unlikely, contrary to a previously published report, that this process can contribute significantly to cosmic gamma rays. Author

N71-37172# Kernforschungszentrum, Karlsruhe (West Germany).
DIVISION OF RADIATION PROTECTION AND SAFETY Annual Report 1970 [ABTEILUNG STRAHLENSCHUTZ UND SICHERHEIT JAHRESBERICHT 1970]
H. Kiefer and W. Koelzer Feb. 1971 182 p refs In GERMAN; ENGLISH summary
(KFK-1365) Avail: AEC Depository Libraries

The different duties of the radiation protection and safety department, at the Karlsruhe Nuclear Research Center, are described, the results of routine measurements for 1970 are listed, and recent results of investigations and developments in the working groups of the department are covered. (NSA)

N71-37173# Lyon Univ. (France). Faculte des Sciences.
STUDY AND DEVELOPMENT OF AN ION DECELERATOR AND ITS APPLICATION TO COLLISION PROBLEMS [ETUDE ET REALISATION D'UN DISPOSITIF DECELERATEUR D'IONS. APPLICATION A QUELQUES PROBLEMES DE COLLISIONS]
Guy Do Cao (Ph.D. Thesis) 1970 70 p refs In FRENCH
(NP-18853) Avail: AEC Depository Libraries

An attempt was made to obtain a sufficiently pure and conveniently focused ion beam for low energy atomic collision studies. An apparatus was developed in which ions are decelerated by a reverse electrostatic field. The vibrational and rotational excitation of the N2(+)B2 sigma ion formed in collisions between slow ions and a molecular nitrogen target was studied. The large population in the upper vibrational and rotational levels of N2(+) was established from heavy-ion collisions. These investigations supply data useful in interpreting polar auroral spectra in which highly abnormal populating of the upper vibrational levels of proton-bombarded nitrogen occurs; this phenomenon may be due to secondary collisions with heavy ions. NSA

N71-37174# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
MAINTENANCE PROGRAM FOR BABYLINE-20 DOSE RATE METERS MANUFACTURED BY NARDEUX [PROGRAMME D'ENTRETIEN ORGANISE DES BABYLINES-20 DE FABRICATION NARDEUX]
Albert Pastre Apr. 1971 36 p In FRENCH
(CEA-N-1435) Avail: AEC Depository Libraries

Instructions for the maintenance of beta gamma ion chamber exposure dosimeters of the Babyline-20 type are given. Three different levels of maintenance are considered. Author (NSA)

N71-37175# Office of Atomic Energy for Peace, Bangkok (Thailand).
SOIL ANALYSIS BY NEUTRON ACTIVATION METHOD
M. L. Nilubol, Prapai Sungtong, and Darakamt Chamniprasart [1971] 8 p refs
(THAI-AEC-36) Avail: AEC Depository Libraries

Neutron activation analysis of soils for trace inorganic elements is discussed. Determination of Al, Mn, Na, Cu, and Zn is described and sensitivity is discussed. NSA

N71-37176# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.
CORRELATION EFFECT IN He-4 AND O-16
V. N. Maksimenko 1971 37 p refs
(ITF-71-1-E) Avail: AEC Depository Libraries

The second-order corrections of the perturbation theory to the variational calculation of binding energies and dimensions of He-4 and O-16 carried out with the oscillator wave functions of the shell model are considered. The wave function of the shell model defines more exactly the average values of one particle operators (kinetic energy, root-mean-square radius) and with less accuracy the two particle operators (potential energy of the pair forces). A variational calculation within the frameworks of the shell model gives a satisfactory approximation in the case of He-4. When calculating the binding energy of the systems like O-16 it is obviously necessary to take into account the configuration mixing. For the pair exchange forces providing for saturation, mixing of the upper configurations in the wave functions of O-16 is of the order of 50%. This result allows one to understand why calculations of the binding energy of atomic nuclei within the shell model do not lead to satisfactory results. Author (NSA)

N71-37177# Paris Univ., Orsay (France). Faculte des Sciences.
FISSION INVESTIGATION USING ON-LINE MASS SPECTROMETRY [CONTRIBUTION A L'ETUDE DE LA FISSION PAR SPECTROMETRIE DE MASSE EN LIGNE]
Jacques Chaumont (Ph.D. Thesis) 1970 97 p refs In FRENCH
(NP-18829) Avail: AEC Depository Libraries

The mass spectrometer used is described and the following points emphasized: construction of the target, elimination of contamination due to naturally occurring elements, and recording of mass spectra. The characteristics of an experiment made with

an external beam from the EL3 pile at Saclay on U and proton beams with uranium, thorium, and tantalum targets at 156 MeV and 24 GeV are discussed. All the 220 cross sections for the isotopes of Rb and Cs were measured; the results obtained are discussed. Although only two elements are considered, the results are very detailed and lead to a good understanding of fission mechanisms. There is good agreement between calculation and experiment on the distribution of Cs isotopes in the fission products produced by 156-MeV protons. NSA

N71-37178# Kernforschungszentrum, Karlsruhe (West Germany).
DECONTAMINATION OPERATIONS DEPARTMENT Annual Report, 1969 [ABTEILUNG DEKONTAMINATIONS BETRIEBE]
H. Krause Jan. 1971 105 p refs In GERMAN; ENGLISH summary
(KFK-1348) Avail: AEC Depository Libraries

Research progress is reported on the fixation of radioactive materials in bitumen, cement, glass, and ceramic materials. A pilot plant was built for demonstration on a larger scale of the decomposition of nitric acid and nitrates by means of formic acid. NSA

N71-37179# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
DETERMINATION OF MICRO AMOUNTS OF ELEMENTS CONTAINED IN NATURAL WATER BY MEANS OF NEUTRON ACTIVATION ANALYSIS
U. Battiston and A. Mosuro 7 Oct. 1970 36 p refs In ITALIAN Presented at the Conf. on Anal. and Phys. Chem. of Water, Bormio, Italy, 9-11 Jul. 1970
(RT/CHI-(70)33; Conf-700717-1) Avail: AEC Depository Libraries

A systematic analytical procedure for determination of As, Au, Co, Cr, Hg, Re, Sb, U, and Zn in natural waters was developed employing neutron activation, gamma spectrometry, and exchange techniques. This procedure was then applied for the determination of microelements in the Tiber River between Corbaras dam and the mouth of the river (about 300 km).
Author (NSA)

N71-37180# Max-Planck-Institut fuer Kernphysik, Heidelberg (West Germany).
SUMMARY TALK, INTERNATIONAL CONFERENCE ON NUCLEAR REACTIONS INDUCED BY HEAVY IONS
Amos de-Shalit Amsterdam North-Holland Publishing Co. Jan. 1970 20 p Conf. held at Heidelberg, 18 Jul. 1969
Avail: NTIS

A transcript of the speech is presented. Fundamental problems in nuclear physics were discussed with the emphasis on problems involving the heavy and super heavy elements.
J.G.M.

N71-37181# California Univ., Berkeley. Lawrence Radiation Lab.
TOTAL LOSS CROSS SECTIONS FOR DZ MOLECULES PASSING THROUGH H2 GAS
Young Pinckney Oliver (Ph.D. Thesis) Apr. 1971 26 p refs
(Contract W-7405-eng-48)
(UCRL-20099) Avail: NTIS

A light ion accelerator with an ion source operating in the PIG mode produced a 10 to the minus 9th power -A D2(+) current. Hydrogen in gas cell 1 neutralized a portion of the primary beam. Hydrogen in gas cell 2 ionized a fraction of the particles that had passed through the target cell. The target pressures varied between 0 and 25 mtorr. All beam-current measurements were made with Faraday cups and electrometers with integrators. The values for the total loss cross sections for D2 increased monotonically. Author (NSA)

N71-37182# California Univ., Berkeley. Lawrence Radiation Lab.
PiN PARTIAL-WAVE AMPLITUDES: A COMPILATION
David J. Herndon, Angela Barbaro-Galtieri, and Arthur H. Rosenfeld Feb. 1970 86 p
(TID-25726) Avail: NTIS

A collection of the results of ten partial-wave analyses performed on the elastic positive pion proton and negative pion proton scattering at 0 to 2 GeV/c is presented. The amplitudes and some parameters deduced from the amplitudes are plotted and tabulated. NSA

N71-37183# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
CONNECTION BETWEEN YANG-MILLS FIELDS AND DUAL MODELS
A. Neveu and J. Scherk Jul. 1971 13 p refs
(LPTHE-71/37) Avail: NTIS

An investigation is conducted of a particular low energy limit of dual models, where the intercept of the leading trajectory is fixed at one, while the slope goes to zero. In this limit, only the pion and the rho meson remain, and they are coupled among themselves through the Lagrangian of the massless Yang-Mills theory. Author

N71-37184# California Univ., Berkeley. Lawrence Radiation Lab.
STRINGENT LIMITS ON THE DECAYS KAON(0) SUB L YIELDS MUON(PLUS) MUON(MINUS), POSITRON ELECTRON, MUON(PLUS OR MINUS) POSITRON OR ELECTRON
Henry Jonathan Frisch (Ph.D. Thesis) 24 Mar. 1971 109 p refs
(Contract W-7405-eng-48)
(UCRL-20264) Avail: NTIS

The search was made with a double arm spectrometer comprised of picture frame magnets and wire spark chambers; data were accumulated with an on-line PDP-9 computer. Running conditions included both helium and vacuum in the decay volume. Approximately 1,041,000 kaon(0) sub L yields pion(+) pion(-) decays were observed; these determine the normalization for the dilepton decay modes. No positron electron or positron or electron muon(+) or muon(-) events were observed, resulting in an upper limit for the branching ratio for each of the above modes of 1.6 x 10 to the -9th power (90% C.L.). One possible muon(+) muon(-) event and at least four background events were detected in the data taken with helium in the decay volume. No muon(+) muon(-) events were detected in the much larger data sample from the evacuated decay volume. If one chooses to ignore the helium data, the vacuum data alone determines a limit on the branching ratio for the decay. Author (NSA)

N71-37185# California Univ., La Jolla. Dept. of Physics.
TRIPLE POMERON VERTEX, DUALITY, AND DIFFRACTION DISSOCIATION
Peter D. Ting and Harry J. Yesian [1971] 11 p refs
(Contract AT(11-1)-Gen-10)
(UCSD-10-P-10-78) Avail: NTIS

By invoking duality for the Reggeon-particle absorptive part the triple Reggeon coupling is related to the low missing-mass spectrum in diffraction dissociation. Existing experimental data are analyzed and suggest that the triple Pomeron coupling is small. Author (NSA)

N71-37186# Brandeis Univ., Waltham, Mass. Dept. of Physics.
RESEARCH IN ELEMENTARY PARTICLE PHYSICS
Technical Progress Report, 1 Sep. 1970 - 30 Apr. 1971
Lawrence Kirsch and Howard J. Schnitzer 31 May 1971 12 p refs
(Contract AT(30-1)-3178)
(NYO-3178-8) Avail: NTIS

Research on the theoretical and experimental properties of elementary particles from September 1, 1970, to April 30, 1971, is summarized. A list of publications is included. NSA

N71-37187# Bettis Atomic Power Lab., Pittsburgh, Pa.
SPATIAL DISTRIBUTION OF THE INDIUM ACTIVATION IN WATER USING A Cf-252 SOURCE (LWBR DEVELOPMENT PROGRAM)
J. P. Semans Mar. 1971 28 p refs
(Contract AT(11-1)-Gen-14)
(WAPD-TM-991) Avail: NTIS

An experiment was conducted to measure the indium activation distribution in water as a function of distance from a Cf-252 fission source. The experiment was compared with a Monte Carlo calculation and a higher approximation of a one dimensional multigroup P-3 calculation, and an attempt was made to infer an experimental age. The intensity of the source limited the experiment to a maximum radius of approximately 20 centimeters. The RECAP and P3MG1 calculations are in reasonable agreement with the experiment. P3MG1 calculations for extrapolation beyond the last experimental point give an age of 30.4 + or - 0.5 sq cm for a water density of 0.9982 g/cu cm. Author (NSA)

N71-37188# Columbia Univ., New York.
SCALING PROPERTIES IN e-p SCATTERING
T. D. Lee Apr. 1971 16 p
(Contract AT(30-1)-1932)
(NYO-1932(2)-188) Avail: NTIS

The discussion of scaling properties in e + p scattering covers the structure functions, results of SLAC experiments, scale, soft and hard mesons, multiplicity, and an SU(2) phenomenological Lagrangian model calculation. NSA

N71-37189# Texas Univ., Austin. Dept. of Physics.
A MODEL FOR DIPOLE ELECTROMAGNETIC FORM FACTORS
Masao Yamada 1970 25 p refs Sponsored by AEC
(ORO-3992-28; CPT-79; AEC-28) Avail: NTIS

A model of the electromagnetic form factor of the scalar pion is discussed in which the pion is a bound state of scalar nucleon-antinucleon system. Starting from an exact integral representation of the form factor, which is well defined in a space like region of the momentum transfer squared, an analytic continuation of the representation is performed under some plausible assumptions on dynamics and a simple pole definition of a resonance in the pion-nucleon scattering amplitude. It is shown that the singularities of the form factor corresponding to resonances turn out to be dipoles and not simple poles contrary to the widely held belief. A generalization to the other hadron cases is discussed in the quark model scheme. Author (NSA)

N71-37190# Brown Univ., Providence, R.I. Dept. of Physics.
COMMENT ON CURRENT ALGEBRA BEYOND THE TREE APPROXIMATION
Chien-li Jen Apr. 1971 12 p refs Sponsored by AEC
(NYO-2262-TA-241) Avail: NTIS

The Schnitzer solution for the s-wave pion pion scattering amplitudes was improved so as to satisfy the crossing relations of Roskies and the Martin inequality relations. Author (NSA)

N71-37191# Los Alamos Scientific Lab., N.Mex.
A NEW METHOD OF SAMPLING THE KLEIN-NISHINA PROBABILITY DISTRIBUTION FOR ALL INCIDENT PHOTON ENERGIES ABOVE 1 keV
C. J. Everett, E. D. Cashwell, and G. D. Turner Apr. 1971 4 p refs
(Contract W-7405-eng-36)
(LA-4663) Avail: NTIS

A Monte Carlo method is given for accurate determination of scattered photon energy in the distribution required by the Klein-Nishia cross section for Compton collisions. The relative error does not exceed 2.2% for all incident energies above 1 keV. Author (NSA)

N71-37192# Los Alamos Scientific Lab., N.Mex.
BREMSSTRAHLUNG EMISSION MEASUREMENT FROM THICK TUNGSTEN TARGETS IN THE ENERGY RANGE 12 TO 300 kV
Ellery Storm, Harvey I. Israel, and Douglas W. Lier Nov. 1970 25 p refs
(Contract W-7405-eng-36)
(LA-4624) Avail: NTIS

X-ray spectral measurements were made using four commercial, tungsten-target, X-ray units operating between 12 and 300 kV. The absolute intensity and the spectral distribution were measured. The effects of varying the tube current, target aperture, and detector aperture were investigated. The intensity from two constant-potential units was proportional to the tube current, but two self-rectified units displayed a departure from linearity as the tube current increased. As the target aperture area was increased, the photon intensity increased rapidly at first, but then leveled off to a constant value. The intensity was found to vary directly with the area of the detector aperture, but the spectra became distorted when the aperture was increased to where the counting rate exceeded 1.2 x 10 to the 4th power counts/sec. Sodium iodide scintillators, germanium and silicon semiconductors, and a xenon proportional counter were used to measure the spectra. The measurements were corrected to obtain an estimate of the undistorted spectra incident on the detectors. The estimate was used as the input to a computer program that simulated the detectors. Author (NSA)

N71-37193# Los Alamos Scientific Lab., N.Mex.
EVALUATED NUCLEAR DATA FOR HYDROGEN IN THE ENDF/B-2 FORMAT
L. Stewart, R. J. LaBauve, and P. G. Young Dec. 1970 18 p refs
(Contract W-7405-eng-36)
(LA-4574; ENDF-141; EANDC(US)-151-A) Avail: NTIS

The following nuclear data are given for hydrogen in the energy range from .00001 eV to 20.0 MeV. The general information file includes a brief description of the data to follow. Values for nuclear spin and effective scattering radius are given in the resonance file. Smooth cross-section data are given for the total cross section, the free-atom elastic scattering cross section, and the radiative capture cross section; data for antimuons, xi hyperons, and photons are also included. The angular distributions for elastic scattering are given as probability vs cosine of the scattering angle. The free-atom scattering cross section is the only information provided at thermal. Secondary gamma ray production multiplicities for capture, which are equal to one, are given. Gamma-ray angular distributions are provided for the single radiative capture gamma ray. Author (NSA)

N71-37194# Oak Ridge National Lab., Tenn. Neutron Physics Div.
MUON TRANSPORT AND THE SHIELDING OF HIGH ENERGY (LESS THAN OR EQUAL TO 500 GeV) PROTON ACCELERATORS
R. G. Alsmiller, Jr., F. S. Alsmiller, J. Barish, and Y. Shima 12 Apr. 1971 41 p refs Presented at the Intern. Congr. on Protection Against Accelerator and Space Radiation, Geneva, 26 Apr. 1971 Sponsored by AEC
(ORNL-TM-3383; Conf-710423-1) Avail: NTIS

Calculated results on the muon shielding required around high energy (200 GeV and 500 GeV) proton accelerator targets are presented. The calculations differ from those presented previously in that, in addition to the angular scattering of the muons due to Coulomb elastic collisions, an estimate of the angular scattering of the muons due to bremsstrahlung production, pair production, and inelastic nuclear collisions is included. It is found that the angular scattering of the muons due to bremsstrahlung production, pair production, and

nonelastic nuclear collisions does not have a pronounced effect on the shield dimensions and therefore for many design purposes may be neglected. The calculations also differ from those presented previously in that the case of laminated shields is considered. Author (NSA)

N71-37185# New York Univ., N.Y. AEC Computing and Applied Mathematics Center.
NUMERICAL SOLUTION OF THE BOLTZMANN EQUATION
Alexandre Josel Chorin Apr. 1971 49 p refs
(Contract AT(30-1)-1480)
(NYO-1480-173) Avail: NTIS

A numerical method for solving the full nonlinear Boltzmann equation is presented, and applied to the problem of shock structure in a gas of elastic spheres. The success of the method hinges on the systematic use of Gaussian quadrature and Hermite interpolation. Author (NSA)

N71-37186# Sandia Corp., Albuquerque, N.Mex.
CALCULATED GENERALIZED OSCILLATOR STRENGTHS FOR THE ATOMS He-Na
Eugene J. McGuire May 1971 84 p refs Sponsored by AEC
(SC-RR-70-406) Avail: NTIS

Tables of generalized oscillator strengths for excitation and ionization of the atoms He through Na are presented.
Author (NSA)

N71-37187# Argonne National Lab., Ill.
EMPIRICAL FORMULA FOR INTERPOLATION OF TABULATED PHOTON PHOTOELECTRIC CROSS SECTIONS
Donald L. Smith Mar. 1971 23 p refs
(Contract W-31-109-eng-38)
(ANL-7796) Avail: NTIS

An empirical formula was useful in the calculation of total photoelectric cross sections for photon energies E sub not listed in tables. The parameters p sub i are determined by least-squares fitting of the formula to tabulated values at neighboring energies. The number of parameters required for a satisfactory fit depends upon the atomic number of the element, the photon-energy range over which the formula is to be applied, and the desired accuracy. This formula was used to fit total photoelectric cross sections for elements Z = 1 to 100 from gamma = 1 keV to 100 MeV photon energy. An agreement between the formula and the tabulated values of better than + or - 3% was sought and obtained. The parameters p sub i extracted from the analysis are presented. Author (NSA)

N71-37188# California Inst. of Tech., Pasadena.
TESTS OF AN EMPIRICAL RULE FOR CUTS AND DISCUSSION OF LINE REVERSAL RELATIONS
Charles B. Chiu 1971 53 p refs Presented at Workshop on Particle Phys. at Intermediate Energies, Pasadena, Calif., 29-30 Mar. 1971
(Contract AT(11-1)-68)
(CALT-68-300; Conf-710316-1) Avail: NTIS

The empirical rule, that cuts are important in the s-channel nonflip amplitude and relatively unimportant in the flip amplitude, consistently distinguishes the success and the failure of the Regge pole model for natural parity meson exchanges. Measurements on the density matrix elements of the omega meson in the reaction pion(+) proton yields omega meson Delta hyperon(2+) will be helpful in understanding the underlying reason for such systematics. A discussion on the line reversal relation is also presented. A prediction of the absorption model on the Lambda hyperon and the Sigma hyperon polarizations in pion(+) proton yields kaon(+) Sigma hyperon(+) and pion(-) proton yields kaon(0) Lambda hyperon and the line reversed reactions is discussed. Measurement of polarizations at high energies will provide a direct test on the absorption picture.
Author (NSA)

N71-37189# Syracuse Univ., N.Y. Dept. of Physics.
GENERAL TREATMENT OF CHIRAL AND SCALE BREAKING IN THE SU(3) SIGMA MODEL
J. Schechter and Y. Ueda Jan. 1971 61 p refs
(SU-1206-241; NYO-3399-241) Avail: NTIS

The model of nine scalar and nine pseudoscalar fields interacting is studied by means of the most general nonderivative chiral SU(3) x SU(3) invariant and any particular symmetry breaker. Two basic generating equations which express the complete content of chiral symmetry are derived. The masses and coupling constants of arbitrary order for this model are simply found by differentiating the generating equations an arbitrary number of times and using an equation which expresses the stability of the ground state. In this way, previous results on this model can be easily recaptured and a systematic framework for the investigation of different symmetry breakers is provided. Numerical estimates are made for scalar meson widths, pion pion and pion kaon scattering lengths, and eta' meson yields eta meson 2 pion decays. The consequences of imposing scale invariance on the invariant part of the interaction are also investigated by writing down a scale invariance generating equation. Finally, the relation between this approach and the method of using the divergences of currents and trace of the energy momentum tensor is discussed.
Author (NSA)

N71-37200# Texas Univ., Austin. Dept. of Physics.
MODEL FOR K SUB l3 FORM FACTORS AND CABIBBO ANGLE
Masao Yamada Feb. 1971 15 p refs Sponsored by AEC
(ORO-3992-39) Avail: NTIS

A quark model of form factors is discussed using Regge pole theory. Within the same model, the Cabibbo angle is also calculated to be 0.26, assuming that the SU(3) breaking is significant for masses in a multiplet but not for the strong couplings. NSA

N71-37201*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INELASTIC SCATTERING CALCULATIONS WITH PROJECTED HARTREE-FOCK WAVE FUNCTIONS: COUPLED CHANNEL TREATMENT
Robert J. Ascuitto, Richard C. Braley, and William F. Ford Sep. 1971 22 p refs
(NASA-TN-D-6419; E-6068) Avail: NTIS CSCL 20H

A completely microscopic coupled-channel study of proton inelastic scattering is made. Proton scattering from Ne-20 and from Mg-24 is investigated. At least the 0(+), 2(+), and 4(+) members of the ground state rotational band of each nucleus are included explicitly in the coupled equations. The nuclear wave functions are obtained by projecting states of good angular momentum from deformed Hartree-Fock intrinsic states. The scattering results are compared with the distorted wave Born approximation (DWBA) and experiment. Truncation of the nuclear model space is also investigated. The results obtained with the microscopic model confirm conclusions drawn earlier based on the macroscopic model. The shapes and deformations predicted by the macroscopic model are well reproduced by the projected Hartree-Fock model which is based purely on energy considerations. Author

N71-37202# Texas Univ., Austin. Center for Particle Theory.
ANALYTICITY, COVARIANCE, AND UNITARITY IN INDEFINITE METRIC QUANTUM FIELD THEORIES
A. M. Gleason, R. J. Moore, H. Rechenberg, and E. C. G. Sudarshan Dec. 1971 38 p refs
(Contract AT(40-1)-3992)
(ORO-3992-26; CPT-77; AEC-26) Avail: NTIS

The general properties of analyticity, covariance, and unitarity are studied in quantum field theories regularized by finite-mass indefinite norm states. After reviewing the general status of indefinite metric theories, a relativistic scalar model is analyzed for covariance and analyticity. This model shows that a

commonly accepted prescription for treating the negative norm states is not covariant, and more sophisticated methods are required. A modified prescription obtained as a limit of the previous result is tested in a more complicated diagram and found to be inadequate for the correction of unitarity difficulties. The general technique of shadow states developed elsewhere is reviewed in order to show their relevance to this problem.
Author (NSA)

N71-37203# Illinois Univ., Urbana. Dept. of Physics.
GENERALIZED SCALING LAWS FOR THE ELECTROPRODUCTION OF HADRONS
John D. Stack [1971] 10 p refs
(Grant NSF GP-8081)
Avail: NTIS

The light cone structure suggested by the quark model is used to derive generalized scaling laws in electroproduction with detection of one final hadron. At fixed momentum transfer between initial and final hadrons, the cross section scales in two variables: the usual Bjorken variable and the fractional longitudinal momentum of the final hadron. Author

N71-37204# Instituto Politecnico Nacional, Mexico City. Escuela Superior de Fisica y Matematicas.
STUDY OF ISOBARIC ANALOGUE STATES BETWEEN 4 AND 8 MeV FOR THE REACTION Ca-48(p,p)Ca-48 [ESTUDIO DE ESTADOS ISOBAROS ANALOGOS ENTRE 4 Y 8 MEV DE LA REACCION CA-48(P,P)CA-48]
Pedro Estrada Tinajero (Ph.D. Thesis) 1970 79 p refs In SPANISH
(NP-18824) Avail: AEC Depository Libraries

Relative excitation functions for proton elastic scattering by Ca-48 at 4 to 8 MeV were measured. Resonances in Sc-49 were observed that are isobaric analogs to levels in Ca-49. NSA

N71-37205# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Physics.
INFLUENCE OF THICKNESS AND SCATTERING ANGLE ON THE STOPPING CROSS SECTIONS OF NITROGEN, NEON, AND ARGON IONS IN THIN CARBON FOILS
G. Hoegberg Nov. 1970 28 p refs
(GIPR-41) Avail: AEC Depository Libraries

The mean stopping cross sections S bar of thin carbon foils are determined. The dependence of stopping cross section on foil thickness and scattering angle is reported. The energy of the incident ions ranged from 12 to 56 KeV. The electronic S(e) and nuclear S(n) stopping cross sections were deduced from the experimentally determined stopping cross sections S bar = S(e) + S(n) by putting S(e) = lim S bar(t) as t approaches zero, where t is the foil thickness. The reported values of S(e) are in reasonably good agreement with previously published results. The mean nuclear stopping cross section in the forward direction is found to reach a saturation value in foils thicker than about 8 mu g/sq cm. The increase of S bar with scattering angle is parabolic at small scattering angles and linear at large ones.
Author (NSA)

N71-37206# Scientific Research Inst. of Electro-Physical Apparatus, Leningrad (USSR).
CALCULATION OF THE INTERNAL STRUCTURE OF NONLAMINAR AXIALLY SYMMETRIC INTENSIVE BEAMS OF CHARGED PARTICLES [RASCHET VNUTRENNEI STRUKTURY NELAMINARNYKH AKSIALNO-SIMMETRICHNYKH INTENSIVNYKH POTOKOV ZARYAZHENNYKH CHASTITS]
V. S. Kuznetsov, V. I. Bogdanova, and O. L. Komarov 1970 20 p refs In RUSSIAN; ENGLISH summary
(NP-18860) Avail: AEC Depository Libraries

A statistical method is considered. A set of equations, describing internal structure of charged particle nonlaminar beams is derived. A nonlaminar model of the beam with nonzero angular velocities is considered and it is shown that this model describes properties of real beams better than nonlaminar models with zero angular velocities. Results of concrete calculations of internal structure of the intense nonlaminar beams, focused by homogeneous longitudinal magnetic fields, are given.
Author (NSA)

N71-37207# Helsinki Univ. (Finland). Research Inst. for Theoretical Physics.
IMPROVED RELATIVISTIC CORRECTIONS TO FERMI-CONTACT HYPERFINE HAMILTONIAN
P. Pyykkoe and E. Pajanne Feb. 1971 12 p
(NP-18818) Avail: AEC Depository Libraries

Following an idea of Breit, a relativistic correction factor to the Fermi-contact hyperfine Hamiltonian is derived for arbitrary principal quantum number n. This n-dependent factor agrees better with an explicit relativistic calculation than the commonly used Racah correction factor.
Author (NSA)

N71-37208# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.
LOGIC OF CONCLUSIVE EXPLICATION OF THE QUANTUM THEORY
Yu. M. Lomsadze 1970 28 p refs
(ITF-70-61-E) Avail: AEC Depository Libraries

Based only on the general principles of the quantum theory (on linearity and unitarity of the evolutional operator, the usual interpretation of the state vector as probability amplitude, and finiteness of velocity of any perturbation spreading), directly on experiment, and on the fundamental thesis of dialectic materialism about primacy of matter with respect to cognition, the uniqueness of explication of this theory is shown. The explication obtained confirms in its turn the deep dialecticity of man's cognition of nature.
Author (NSA)

N71-37209# Atomic Weapons Research Establishment, Aldermaston (England).
ELASTIC AND INELASTIC SCATTERING OF 5.0 Mv NEUTRONS BY SODIUM
R. E. Coles Feb. 1971 12 p refs
(AWRE-O-3/71) Avail: AEC Depository Libraries; HMSO 10 p; BIS $0.40

Differential cross sections at ten angles between 30 deg and 135 deg were measured for elastic scattering and for inelastic scattering to seven levels up to 3.88 MeV excitation in the target nucleus. This work was originated to provide information on the shape of the elastic angular distribution and where appropriate, comparisons are made with existing data in the UKAEA Nuclear Data File No. 182 for sodium.
Author (NSA)

N71-37210# Idaho Nuclear Corp., Idaho Falls.
PHROG: A FORTRAN 4 PROGRAM TO GENERATE FAST NEUTRON SPECTRA AND AVERAGE MULTIGROUP CONSTANTS
R. L. Curtis, G. L. Singer, F. J. Wheeler, and R. A. Grimesey Apr. 1971 111 p refs
(Contract AT(10-1)-1230)
(IN-1436) Avail: NTIS

The code recursively solves either a P-1 or P-1 approximation to the energy dependent transport equation utilizing cross section data obtained from a library. Legie has been incorporated to calculate both resolved and unresolved resonance data to complement the library absorption and fission data where necessary. The code generates up to 40 broad groups of average cross section data utilizing a 66 fine group cross section library covering an energy range from 10 MeV to .414 eV and containing data for approximately 200 materials. The code contains options for the punching of cross section and spectral data for use in future problems or in other codes. The code is written in FORTRAN and is presently operating on an IBM 360/75. A typical problem generally requires less than one minute of CPU time.
Author (NSA)

N71-37211# Argonne National Lab., Ill.
PROCEEDINGS OF INTERNATIONAL CONFERENCE ON BUBBLE CHAMBER TECHNOLOGY, VOLUME 1
M. Derrick, (ed.) [1970] 591 p refs Conf. held at Chicago, 10-12 Jun. 1970 Sponsored by AEC
(Conf-700823-Vol-1) Avail: NTIS

Papers are presented on neutrino physics in relation to existing chambers. Bubble chamber design, targets, and photography are discussed. K.P.D.

N71-37212# Argonne National Lab., Ill.
PROCEEDINGS OF INTERNATIONAL CONFERENCE ON BUBBLE CHAMBER TECHNOLOGY, VOLUME 2
M. Derrick, (ed.) [1970] 641 p refs Conf. held at Chicago, 10-12 Jun. 1970 Sponsored by AEC
(Conf-700823-Vol-2) Avail: NTIS

Bubble chamber research at existing facilities is discussed. Bubble chamber photography, lenses, targets, and magnetic effects are considered. K.P.D.

N71-37213# Oak Ridge National Lab., Tenn.
INSTRUCTIONS FOR THE OPERATION OF CODES ASSOCIATED WITH MECC-3, A PRELIMINARY VERSION OF AN INTRANUCLEAR CASCADE CALCULATION FOR NUCLEAR REACTIONS
H. W. Bertini, M. P. Guthrie, and O. W. Hermann May 1971 53 p refs
(Contract W-7405-eng-26)
(ORNL-4584) Avail: NTIS

Instructions for the operation of MECC-3 and associated editing codes are given. MECC-3 will operate over the ranges of 1 to 3500 MeV for incident nucleons and 1 to 2500 MeV for incident pion(+) and pions(-) for targets ranging from He-4 to Pu-239. The calculation is expected to be valid, however, only over the range from about 100 to 2000 MeV for targets heavier than carbon. The programs operate on the IBM 360/75 and 360/91 computers. Author (NSA)

N71-37214# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
ENDF/B CROSS SECTION PREPARATION AND TESTING IN THE JOSHUA SYSTEM
D. R. Finch, H. C. Honeck, J. W. Stewart, II, and W. V. Baxter Mar. 1971 8 p refs
(Contract AT(07-2)-1)
(TID-25890) Avail: NTIS

The features of the JOSHUA cross section subsystem and the JOSHUA operating system of prime importance to the user are described. The cross section subsystem provides cross-section and cell-spectrum modules to perform averaging, weighting, group collapsing, and spectrum calculations as required. The JOSHUA operating system provides execution of function commands from the terminal facilities and data sets to store information both temporarily and for longer periods. The benefits to the user are to reduce the load of purely manipulative tasks and to reduce the total time required to perform a sequence of operations on cross section data. The cross section subsystem allows the evaluator of cross sections to perform more calculations and more meaningful calculations with a set of cross section data. To the routine user of cross sections, the subsystem provides facilities for creating a set of cross sections for any purpose. NSA

N71-37215# California Univ., Los Angeles. Dept. of Physics.
RESEARCH PROGRAM OF THE NUCLEAR CONSORTIUM AT THE UCLA CYCLOTRON LABORATORY, JULY 1970
J. Reginald Richardson, Byron T. Wright, Harriet H. Forstor, and Robert M. Eisberg Jul. 1971 195 p refs
(Contract AT(11-1)-Gen-10)
(UCLA-10-P-18-23; AR-5) Avail: NTIS

Beta decay schemes for antimony-110, 111, and 114 are reported as well as beta and electron-capture decay schemes for antimony-112 and 113. Results of cyclotron studied are summarized for proton reactions and angular distributions for fluorine-19, carbon-12, and lead-208; proton reactions and differential cross sections for gold-197, nickel-59, and tantalum-181; kinematic analysis of helium-3 proton reactions; and neutron reactions and angular distributions for tritium and helium-3. J.M.

N71-37216# Hanford Engineering Development Lab., Richland, Wash.
NEUTRON ENERGY DEPENDENT CROSS SECTION EVALUATION BY A MULTIPLE FOIL ACTIVATION METHOD
W. N. McElroy, R. L. Simons, J. A. Uleeth, and L. S. Kellogg 1970 10 p refs Presented at the Third Conf. on Neutron Cross Sections and Technology, Knoxville, Tenn., 15 Mar. 1971
(Contract AT(45-1)-2170)
(WHAN-SA-107; Conf-710301-13) Avail: NTIS

The timely evaluation and definition of energy-dependent reaction cross sections sigma(E) in the energy region above approximately .00001 MeV is important for the liquid metal fast breeder reactor program. Previous studies demonstrated the feasibility of a multiple foil activation iterative method for sigma(E) definition and evaluation. Recent applications of this method have produced evaluations of sigma(E)'s for such reactions as Au-197(n,gamma)Au-198 and Cu-63(n,alpha)Co60. Energy-dependent cross sections, based on monoenergetic measurements and theoretical estimates, are generally inconsistent with activation measurements, which are inherently of an integral nature. Energy-dependent cross sections determined by activation methods as described here can detect and remove such inconsistency. The large discrepancy between recent monoenergetic and integral measurements for Cu-63(n,alpha)Co-60 emphasizes the need for removing such inconsistencies. Author (NSA)

N71-37217# Kanner (Leo) Associates, Redwood City, Calif.
COLLECTIVE BEAM ACCELERATION
V. N. Tsytovich Feb. 1971 10 p refs Transl. into ENGLISH of Russian report JINR-P9-5091
(UCRL-Trans-1443; JINR-P9-5091) Avail: NTIS

The possibilities of acceleration of plasma bunches and relativistic electron rings using the action of relativistic electron beams are discussed. The acceleration due to the coherent Cherenkov and coherent transitional radiation is considered. Author (NSA)

N71-37218# Du Pont de Nemours (E. I.) and Co., Aiken, S.C.
NEUTRON-INDUCED FISSION CROSS SECTIONS FOR Cm-244 TO Cm-248 AND Cf-249
R. W. Benjamin, K. W. MacMurdo, and J. D. Spencer [1970] 6 p refs Presented at the 3rd Conf. on Neutron Cross Sections and Technol., Knoxville, Tenn., 15 Mar. 1971
(Contract at(07-2)-1)
(DP-MS-70-95; Conf-710301-12) Avail: NTIS

Thermal fission cross sections and fission resonances integrals have been measured for Cf-249 and Cm-244 to Cm-248 with both dual fission chambers and plastic fission-track recorders. Measurements were made in the core and thermal column of a research reactor. Cross sections were determined through direct comparison with the U-235 cross sections. The low-energy cutoff for the resonance integral was adjusted to 0.625 eV. Author (NSA)

N71-37219# Idaho Nuclear Corp., Idaho Falls.
FAST-NEUTRON CAPTURE INTEGRAL MEASUREMENTS OF Tc-99, Ag-109, AND OTHER FISSION PRODUCTS
Y. D. Harker [1970] 9 p refs Presented at the 3rd Conf. on Neutron Cross Sections and Technol., Knoxville, Tenn., 15 Mar. 1971 Sponsored by AEC
(Conf-710301-4) Avail: NTIS

A reactivity measuring device which has a neutron spectrum

approximating that of a typical LMFBR was used to measure fast-neutron integral capture cross sections. The integral measurements provide important checks for evaluating differential cross section data and calculations. The measurements for Tc-99, Ag-107, Ag-109, In-115, Cs-133, Pr-141, Ho-165, and Tm-169 are reported. The measurements are compared with calculated integrals derived mainly from the predicted cross sections. For Tc-99, a systematic approach was applied to get an approximate differential cross section whose integral compared very well with the measured value.
Author (NSA)

N71-37220# Brookhaven National Lab., Upton, N.Y. National Neutron Cross Section Center.
DATA FORMATS AND PROCEDURES FOR THE ENDF NEUTRON CROSS SECTION LIBRARY
M. K. Drake, (ed.) Oct. 1970 220 p refs Supersedes BNL-8381 and BNL-50066(ENDF-102) Sponsored by AEC (BNL-50274(T-601)) Avail: NTIS

The philosophy of the Evaluated Nuclear Data File (ENDF) and the data formats and procedures to be used for entering data into the ENDF library are described. The general features of the ENDF libraries, the relation between ENDF and CSISRS (Cross Section Information Storage and Retrieval System), and the relation between ENDF and its secondary libraries are reviewed. The standard formats used in all record types are detailed. The arrangement of the various types of data are discussed. The file is illustrated for elastic scattering by natural Ni.
NSA

N71-37221# Gulf Radiation Technology, San Diego, Calif.
FAST REACTOR SPECTRUM MEASUREMENTS Technical Summary Report, 1 Feb. 1970 - 31 Jan. 1971
Jack C. Young, G. M. Borgonovi, J. M. Neill, E. L. Slaggie, and K. L. Crosbie 16 Mar. 1971 123 p refs
(Contract AT(04-3)-167)
(GULF-RT-10823) Avail: NTIS

A continuing program of fast neutron spectrum measurements by time-of-flight methods in a subcritical facility (STSF) is described. Results of measurements and calculations for the STSF-1A, STSF-8, and STSF-9 systems are presented. Studies of techniques for measuring spectra with proton recoil detectors are also described.
Author (NSA)

N71-37222# Conservatoire National des Arts et Metiers, Paris (France).
ELECTROSTATIC SYSTEMS FOR ION TRANSPORT [SYSTEMES ELECTROSTATIQUES DE TRANSPORT D'IONS]
Jacques Excoffon Dec. 1970 61 p refs In FRENCH
(NP-18866) Avail: AEC Depository Libraries

Two electrostatic ion transport devices are described. The mathematical analysis used for their construction is given; only first order terms were considered in the study of the trajectories and images, and the geometrical aberrations were not taken into account. The on-line devices of the Orsay Nuclear Physics Institute and that of CERN at Geneva are described.
NSA

N71-37223# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
GAMOW-TELLER 1(PLUS) EXCITATIONS IN ODD-ODD NUCLEI
S. I. Gabrakov, A. A. Kuliev, and D. I. Salamov 1971 12 p refs In RUSSIAN
(JINR-P4-5744) Avail: AEC Depository Libraries

In the framework of the random phase approximation beta-decay properties of highly excited 1(+) states in odd-odd deformed nuclei are investigated. These states are collectivized by a charge exchange residual interaction. The calculations show that for negative beta transitions the collective state (the Gamow-Teller resonance) is at an excitation energy of the order of 20 MeV. The calculations of the strength functions for the Gamow-Teller transitions show that this state exhausts the main part of the allowed transition. The strength of positive beta transition is concentrated in the energy region of bound states.
Author (NSA)

N71-37224# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
DERIVATION OF CORRECTIONS TO K INFINITY IN THE TWO-GROUP APPROXIMATION
E. P. Lippincott May 1971 17 p refs
(Contract AT(45-1)-1830)
(BNWL-1560) Avail: NTIS

An improved derivation of the correction terms necessary to evaluate k infinity from experimental data in the unpoisoned and poisoned techniques is presented. Earlier derivations are extended to include epithermal fissions and correct minor errors in the earlier results. A new formula for k infinity is derived in which the buckling has been eliminated in order to allow a more accurate value of k infinity to be determined.
Author (NSA)

N71-37225# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
SOLUTION OF THE INVERSE REACTION PROBLEM FOR COMPLEX POTENTIALS
W. K. Bertram and J. L. Cook Feb. 1971 5 p refs
(AAEC/TM-586) Avail: AEC Depository Libraries

A method is given for solving the inverse reaction problem to obtain complex potentials as in the optical model of the nucleus. The method will reproduce reaction data to the accuracy with which the reaction matrix can be least-squares fitted to a sum of simple poles.
Author (NSA)

N71-37226# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
TABLES OF GAMMA RAYS FROM (n, GAMMA) PRODUCED NUCLIDES
R. A. Greig, R. E. J. Porritt, and S. J. Bone Feb. 1971 64 p refs
(AAEC/TM-585) Avail: AEC Depository Libraries

A rearrangement of gamma-ray energy tables is made to enable rapid identification of gamma spectra. Tables are arranged thus: (1) major gamma rays ordered by energy (each energy followed by all other gamma rays from that particular nuclide); (2) all gamma rays ordered by energy; (3) gamma rays from mass-ordered nuclides.
Author (NSA)

N71-37227# Atomic Energy Commission Research Establishment, Riso (Denmark).
THE NEUTRON RESONANCE REACTIONS IN THERMAL NUCLEAR REACTORS DETERMINED BY SEMI-ANALYTIC AS WELL AS NUMERICAL METHODS
Joern Mikkelsen (Ph.D. Thesis) Nov. 1970 168 p refs
(RISO-234) Avail: AEC Depository Libraries

The methods investigated comprise intermediate resonance semi-analytic methods, statistical treatments, and numerical heterogeneous or homogeneous slowing-down calculations with resonance overlap included or excluded. The influence of detailed spatial flux distributions, the accuracy of the equivalence principles, and methods of constructing effective group cross sections from simple resonance-integral tabulations received special attention. It is concluded that the best way to profit from the improved resonance treatments in standard multigroup reactor computation is to make use of tabulations such as those just mentioned. Apart from summarizing these studies, the report describes the RESAB program system developed in connection with the investigation.
Author (NSA)

N71-37228# Hamburg Univ. (West Germany).
THE CALCULATION OF PHOTOIONIZATION CROSS SECTION BY THE SCALED THOMAS-FERMI METHOD [DIE BERECHNUNG VON PHOTOIONISATIONS-

QUERSCHNITTEN NACH DER SCALED THOMAS-FERMI-METHODE]
Helmuth Kaehler (Ph.D. Thesis) 1970 35 p refs In GERMAN
Avail: NTIS

The semi-empirical scaled Thomas-Fermi method uses extrapolation of ground level numbers to free states for calculating atomic photoionization cross sections in the presence of strong fields and high quantum defects. Example calculations on Na, K, Mg, C, N, and O atoms agree well with quantum dynamical calculations of smaller electron energy cross sections for those cases where Coulomb approximations are feasible and the empirical energy levels are known. The semi-empirical scaled Thomas-Fermi method proves advantageous for calculating s-level cross sections of complex atoms where the variable scale factors provide indications for the useful application of the model. Transl. by G.G.

N71-37228# Technische Hochshule Munchen (West Germany). Fakultaet fuer Allgemeine Wissenschaften.
MANUFACTURE AND COLUMN CHROMATOGRAPHIC ISOLATION OF BIOMEDICAL GRADE PLUTONIUM-238 [HERSTELLUNG UND SAEULENCHROMATOGRAPHISCHE ISOLIERUNG VON "BIOMEDICAL GRADE" PLUTONIUM-238]
Siegfried Specht (Ph.D. Thesis) 1971 173 p refs In GERMAN
Avail: NTIS

An improved separation method is described for producing ultrapure Pu-238 through separation from radiolytic reaction products in an ion exchanger. A mixed bed column consisting of extremely fine resin grains provides fast and clean separations of the various Pu oxidation products from the radiolytic solution. Pu-238 is used in radioactive batteries as energy supply for implanted organic prosthetic devices. Transl. by G.G.

N71-37230# Rome Univ. (Italy). Inst. of Physics.
A GENERALIZED VENEZIANO MODEL WITH SPIN AND ISOSPIN FOR NNKK PI PROCESSES
G. Benfatto, M. Lusignoli, and F. Nicolo 18 Nov. 1970 36 p refs *Its* Nota Interna No. 291
Avail: NTIS

A Veneziano-type model is proposed for the nucleon antinucleon processes having the correct asymptotic behavior and spin structure, the right isospin and signature on the parent trajectories, and the appropriate factorization properties on the lowest poles. The requirement of a minimum number of satellite terms greatly reduces the number of free parameters.
Author (ESRO)

N71-37231# Naval Research Lab., Washington, D.C.
DEPENDENCE OF THE INTENSITY OF CHARACTERISTIC X-RADIATION ON THE CHARGE OF THE NUCLEUS [ZAVISIMOST INTENSIVNOSTI RENTGENOVSKOGO KHARAKTERISTICHESKOGO IZLUCHENIYA OT ZARYADA YADRA]
V. F. Truscv 21 Jun. 1971 6 p refs Transl. into ENGLISH from Izv. Vyssh. Uchsb. Zaved., Fiz. (USSR), v. 13, no. 1, 1970 p 148-150
(AD-726734; NRL-TRANS-1231) Avail: NTIS CSCL 20/8

In the study of radiative electric multipole transitions in the X-ray region of the spectrum, particularly in the case of heavy atoms, it is necessary to use the relativity theory with allowance for retardation. In the present work, the ratios of line intensities in the X-ray spectrum were calculated by using an analytic potential. GRA

N71-37232# Yale Univ., New Haven, Conn. Dept. of Physics.
STUDIES OF THE PROPERTIES OF ATOMS, MOLECULES AND PLASMAS BY THE METHODS OF RADIOFREQUENCY, MICROWAVE AND OPTICAL SPECTROSCOPY Final Report
Vernon W. Hughes and Willis E. Lamb, Jr. 25 May 1971 19 p (Grant AF-AFOSR-0249-67)
(AD-726648; AFOSR-71-1840-TR) Avail: NTIS CSCL 07/4

A brief summary is given of research which included precise measurements on simple atoms and molecules with particular emphasis on properties of fundamental importance to physical theory, studies of lasers and masers, and experimental and theoretical studies of atomic collisions. Author (GRA)

N71-37233# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.
THE EFFECT OF ANGULAR DISTRIBUTION OF COMPTON ELECTRONS ON HIGH ALTITUDE EMP SOURCE CURRENTS
William T. Wyatt, Jr. Apr. 1971 147 p
(AD-726928; USAMERDC-2006) Avail: NTIS CSCL 20/8

High-altitude EMP source currents and ionization resulting from Compton scattering of gamma rays were evaluated on the basis of the forward-scattering of the Compton electrons. Large differences were noted between results of the most accurate approximation and the forward-scattering approximation for the case of relativistic Compton electrons, especially of late times. Accuracy at late times required a more accurate approximation than at early times. A special forward-scattering approximation was tested which should allow accurate evaluation of peak fields below the source region. Author (GRA)

N71-37234# Miami Univ., Coral Gables, Fla. Center for Theoretical Studies.
SYMMETRY PRINCIPLES ANALYSIS OF SUBNUCLEAR SYSTEMS FOR USE IN POWER PRODUCTION Final Report, 1 Jun. 1969 - 31 May 1971
Behram Kursunoglu Jun. 1971 10 p refs
(Grant AF-AFOSR-1268-67)
(AD-726657; AFOSR-71-1960-TR) Avail: NTIS CSCL 20/8

The report contains a brief summary of the research performed between 1 June 1969 and 31 May 1971. Much of the work was based on understanding the nature of elementary particles and their interactions from a fundamental viewpoint, while some of it was concerned with mathematical aspects and also with the phenomenology. Included in this work was the development of the Kursunoglu supermultiplet theory generalized to particles of all spins. Author (GRA)

N71-37235# RAND Corp., Santa Monica, Calif.
NUCLEAR CRITERIA AND SYSTEM DESIGN SPECIFICATION
Richard R. Schaefer Dec. 1970 10 p
(AD-727010; P-4535) Avail: NTIS CSCL 18/8

In order that nuclear hardness criteria might receive proper consideration in system design specifications, it is desirable to have a formalism in which the cost and benefits of nuclear hardness can be examined together with the cost and benefits of alternatives to hardness. The paper presents such a formalism.
Author (GRA)

N71-37236# Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.
ROTATIONAL RELAXATION OF HD
Kazuo Takayanagi Jul. 1971 12 p refs *Its* vol. 36, no. 9 (ISAS-467) Avail: NTIS

Sound absorption experiments showed that in the gaseous HD below 40 K, the rotational collision number has a temperature-independent value of about 10. The results are compared with theoretical calculations. The theoretical collision number is not temperature-independent, but its dependence is weak. Possibilities for reducing the remaining discrepancies are suggested. Author

N71-37237# Rome Univ. (Italy). Istituto di Fisica.
STRUCTURE OF FUNDAMENTAL INTERACTIONS Final Scientific Report, 1 Jun. 1967 - 30 Sep. 1970
Nicola Cabibbo 30 Sep. 1970 15 p refs

(Contract F61052-67-C-0084)
(AD-726861; AFOSR-71-1959TR) Avail: NTIS CSCL 20/6

The report summarizes the work in elementary particle physics performed under the Contract. Research on weak and electromagnetic interactions and structures of hadrons, scattering of hadrons, Regge theory and dispersion relations, K-N scattering, and high energy pion photoproduction is reported. Understanding of the relationship between weak and strong interactions has advanced to the point where some understanding has been gained of the possible role of weak interactions in symmetry breaking. Investigation of light-cone singularities and deep inelastic scattering has also yielded interesting results. Results of research of the theory of Regge poles and the methodology of finite energy sums have been successfully applied to the study of K-N scattering and of pion photoproduction. Author (GRA)

N71-37238# Cambridge Memories, Inc., Newton, Mass. Magnetic Thin Film Development Dept.
RESEARCH IN FERROMAGNETICS: DOMAIN TIP PROPAGATION DEVICES
Harvey I. Jauvtis and Robert J. Spain 31 Mar. 1971 86 p refs
(Contract F19628-69-C-0270)
(AD-726821; AFCRL-71-0289; SR-2; Rept-070-S2) Avail: NTIS CSCL 09/2

The effect of nuclear radiation on domain tip (DOT) film elements was investigated. Experiments showed that DOT films are not effected by fast neutron fluxes up to at least 10 to the 14th power n/sq cm which is the maximum dosage considered. DOT inductive readout was studied and the dependence of signal amplitude and width on channel width and pickup loop geometry established. A new diode shift register propagation technique is described and results of studies of diode element and domain stability presented. Author (GRA)

N71-37239# Maryland Univ., College Park. Center for Theoretical Physics.
A WAY TO TEST CAUSALITY IN THE RHO MESON SYSTEM
Michael Creutz Jul. 1971 14 p refs
(Grant NSF GU-2061)
(TR-72-003) Avail: NTIS

An experimental procedure is outlined for determining whether the rho meson is a normal pole in the second sheet of the energy plane or a non-causal pole in the first sheet. This determination uses electromagnetic corrections to the reaction pion(-) + proton yields pion(+) + pion(-) + neutron. It is found that for certain kinematics the rho mesons produced in this reaction will appear to be shifted in mass in a direction controlled by the position of the rho pole. For an 8 to 10 BeV beam energy, 4% of the events will be shifted by roughly 1 to 2 MeV. Author

N71-37240# Maryland Univ., College Park. Dept. of Physics and Astronomy.
ANALYSIS OF THE SIGMA-MODEL FORMALISMS WITH REFERENCE TO PION PION SCATTERING LENGTHS
A. A. Golestaneh Aug. 1971 23 p refs Sponsored in part by AEC
(Grant NSF GY-8532)
(TR-72-023) Avail: NTIS

The sigma-model formalisms were studied in direct products of SU(2) and SU(2) and SU(3) and SU(3) in order to obtain not only the mass formulas of the scalar and pseudoscalar mesons, but also the coupling constants of the scalar mesons' decays into two pions, and the pion pion scattering lengths. These are found with an appropriate choice of the interaction terms in the Lagrangian. However, in such a model, the expression of the partially conserved axial vector current (PCAC) which is linearly proportional to the pion field is supplemented by the terms which contain the product of the three fields. The total contribution of these PCAC violating terms, to the matrix elements of the divergence of the weak hadronic current (namely A), is negligible and may be ignored. The nonlinear sigma-model is also considered, in which one of the field components (chosen to be the singlet scalar field) is determined by a chiral constant. Author

N71-37241# Maryland Univ., College Park. Center for Theoretical Physics.
CURRENT SOURCE OF THE PSEUDOSCALAR FIELD AND SIGMA-MODEL FORMALISMS
A. A. Golestaneh and C. E. Carlson (Chicago Univ., Ill.) Aug. 1971 31 p refs Sponsored in part by AEC
(Grant NSF GU-2061)
(TR-72-019) Avail: NTIS

The field source relation associated with the pseudoscalar meson is considered. Using the sigma-model formalism, in both direct SU(2) x SU(2) and SU(3) x SU(3) symmetries, it is shown that this field source relation is the Euler-Lagrange equation of motion. The current-source J is derived from the same Lagrangian which gives the weak hadronic current (namely A), the partially conserved axial vector current relation and the mass spectra of the scalar and pseudoscalar mesons. The equal-time commutation (ETC) relations of the currents A and J are also derived. It was found that the algebra of these currents are closed with two vector currents which are related by the shift of the scalar sigma field. However, for the pions and eta-meson, these two vector currents are divergenceless and identical. The (ETC) relation of the current-divergence of the current J differs from that of the current A by a tensor term with respect to symmetry indices. For low-energy pion-pion scattering, an approximate expression is derived for the latter commutation relation. Author

N71-37242# Maryland Univ., College Park. Center for Theoretical Physics.
COMPLEX POMERON SINGULARITIES AND ASYMPTOTIC BEHAVIOUR
Roger Zaoui Jul. 1971 11 p refs
(Grant NSF GU-2061)
(TR-72-010) Avail: NTIS

It is assumed that the partial wave amplitude of the scattering of two-body scalar bosons, in the t channel, has a complex conjugate pair of the Pomeron singularities. An asymptotic expansion is obtained for the scattering amplitude. The properties of this amplitude are discussed in connection with the Froissart bound and the violation of the Pomeranchuk theorem. Author

N71-37243# Maryland Univ., College Park. Center for Theoretical Physics.
ASYMPTOTIC SU(3) SYMMETRY, GENERALIZED BOSON NONET COUPLINGS AND THE NINTH PSEUDOSCALAR MESON
S. Oneda and Seisaku Matsuda (Brooklyn Polytechnic Inst., N.Y.) Aug. 1971 6 p refs
(Grant NSF GP-8748)
(TR-72-021) Avail: NTIS

In the framework of asymptotic SU(3) symmetry and the chiral direct product of SU(3) and SU(3) charge algebra, it is shown that nonet boson couplings and mass relations exhibit certain simple patterns. In particular, Schwinger's mass formulas emerge for boson nonets and its implications for the X(959) and E(1422) is discussed. Author

N71-37244# Maryland Univ., College Park. Center for Theoretical Physics.
SUM RULES IN NEUTRINO SCATTERING AND SCALE DIMENSION OF CHIRAL SYMMETRY BREAKING HAMILTONIAN
Feyyazuddin (Islamabad Univ., Pakistan) and Riazuddin Sep. 1971 11 p refs
(Grant NSF GU-2061)

(TR-72-034) Avail: NTIS

A current algebra sum rule for the structure function W sub 5, together with a light cone analysis, is used to determine the scale dimension of chiral symmetry breaking Hamiltonian. The structure function occurs in the neutrino scattering because of the nonconservation of the axial vector current. Author

N71-37245# European Organization for Nuclear Research, Geneva (Switzerland).

PHASE ACCEPTANCE OF AN ALTERNATING GRADIENT DOUBLET MADE OF QUADRUPOLES OF DIFFERENT APERTURES

E. Regenstrief 4 May 1971 55 p ref

(CERN-71-11) Avail: AEC Depository Libraries

The phase space behavior of a quadrupole doublet is examined under more general conditions than in previous studies. The constraint of equal apertures of the quadrupoles making up the doublet has been lifted. It is shown that under these conditions the phase space contour in either the focusing-defocusing plane or in the defocusing-focusing plane may have ten different shapes. For each of them the phase acceptance area is evaluated. NSA

N71-37246# United Kingdom Atomic Energy Authority, Harwell (England).

SPECIFIC 2. A MONTE CARLO PROGRAM FOR HIGH ENERGY NEUTRON SPECTRUM ESTIMATION

D. W. Holbrough and B. A. Lipscombe Mar. 1971 44 p refs

(AERE-R-6822) Avail: AEC Depository Libraries; HMSO 30 p: BIS $1.20

SPECIFIC 2 is a Monte Carlo Code, written in IBM System/360 FORTRAN 4 for estimating the high energy neutron spectrum resulting from either a fission source or a specified monoenergetic source in cylindrical (R,Z) geometry. It is possible to treat rods, that is, independent cylinders not centered on the origin. The code will accept problem data in free format. A prelude facility, similar to that available for the 52 compiler on the STRETCH computer, is incorporated whereby the demand for fast core is reduced to a minimum for problems of varying size and complexity. Estimates are made of the variances of the results, and options are available to integrate tabulated functions over the spectra produced and to present such spectra in a graphical form. Author (NSA)

N71-37247# United Kingdom Atomic Energy Authority, Harwell (England).

COSMIC: A MONTE CARLO PROGRAM FOR THERMAL NEUTRON RE-THERMALISATION STUDIES

P. Carter and D. W. Holbrough Mar. 1971 40 p refs

(AERE-R-6658) Avail: AEC Depository Libraries; HMSO 27 p: BIS $1.20

Beams of rethermalized neutrons from research reactors produced with the aid of hot and cold neutron sources are used for experimental studies in the fields of liquid and solid state research. To optimize the design of such sources a method was devised to overcome the problem of treating small moderator regions having complex geometry in which anisotropic scattering takes place, and which are subject to high flux gradients. This method was embodied in the Monte Carlo program COSMIC described. The program, written in IBM system/360 FORTRAN 4, estimates the spectrum and associated errors of the neutron beam within and leaving the source block, described in cylindrical geometry with provision for a limited number of curved surfaces, for a specified incident thermal reactor spectrum. Details of problem input and the required nuclear data are given. A facility is described for allocating array space at program load time whereby a range of problems may be readily accommodated. Author (NSA)

N71-37248# Commissariat a l'Energie Atomique, Fontenay-Aux-Roses (France). Centre d'Etudes Nucleaires.

RESEARCH OF A BIASING SYSTEM FOR THE CALCULATION OF THE DEEP PENETRATION OF NEUTRONS BY A MONTE CARLO METHOD

J. M. Lanore [1971] 10 p refs Presented at Meeting on New Develop. in Reactor Math. and Appl., Idaho Falls, Idaho 29 Mar. 1971

(CEA-Conf-1755; Conf-710302-12) Avail: AEC Depository Libraries

The deep penetration of neutrons in shielding materials is considered. It is a problem difficult to solve with the Monte Carlo method because the variance increases with the distance from the source and becomes too high at long distances. A biasing system was studied to obtain a variance that does not depend on the distance. Two cases were considered: a homogeneous medium with constant cross sections and without inelastic scattering and a real homogeneous medium. The precision obtained is good. NSA

N71-37249# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy).

ELECTRON SCATTERING ON NUCLEI: A BRIEF REVIEW

D. B. Isabelle Dec. 1970 13 p refs Presented at Meeting on Electrosynchrotron, Frascati, Italy, 5-7 Nov. 1970

(LNF-70/57; Conf-701121-3) Avail: AEC Depository Libraries

Typical spectra of scattered electrons can be divided into regions of elastic scattering, inelastic scattering, quasi-elastic scattering, and quasi-inelastic scattering. Typical experimental arrangements are described, and the expression for the electron-scattering cross section is presented. The kinds of information that may be obtained from electron scattering are discussed, and methods for dealing with radiative corrections are presented. Sample spectra from electron inelastic scattering by Ti-48 at 96 MeV are given, as well as elastic form factors for B-10 and B-11. NSA

N71-37250# Institute of Nuclear Physics, Krakow (Poland).

MODELS OF THE ELASTIC SCATTERING OF ALPHA PARTICLES

M. Makowska-Rzeszutko, A. Dudek, and A. Drzymala Dec. 1970 60 p refs

(INP-735) Avail: AEC Depository Libraries

An analysis was carried out of the elastic scattering of 25 MeV alpha particles measured for 24 elements. Experimental angular distributions were reproduced by the Frahn-Vebter model, Springer-Harvey models, and the optical model. The models were compared and the angular range applicable for each model and the reproducibility of the syms sub R values were examined. For the strong absorption models, the energy dependence of parameters was observed and ambiguity of models was found. Geometrical parameters of nuclei were calculated and listed along with results of another author. Author (NSA)

N71-37251# Illinois Univ., Urbana. Physics Dept.

CLUSTER DECOMPOSITION PROPERTIES OF PHI-3 PERTURBATION THEORY AMPLITUDES AT HIGH ENERGY. 2

David K. Campbell and Shau-Jin Chang Aug. 1971 67 p refs

(Grant NSF GP-25303)

(ILL-(TH)-71-10) Avail: NTIS

The validity of a q-variable cluster decomposition in phi 3 field theories is studied by exploring the relationship between the k and q-variable approaches and a number of subtleties involved in the introduction of q-variable clusters. Considered is the q-variable cluster decomposition of the partially differential cross sections obtained by integrating over the transverse momentum components. The resulting cluster decomposition, essentially in terms of the rapidities corresponding to the longitudinal components of the q sub i, provides a direct and intuitive framework for theoretical calculations of inclusive multi-particle spectra. Examples of the cluster approach in two brief model calculations of inclusive particle spectra are given. Author

N71-37252 National Lending Library for Science and Technology, Boston Spa (England).
THE ROAD TO SUPERNUCLEI
G. Flerov 26 Mar. 1971 7 p Transl. into ENGLISH from Pravda (Moscow), 8 Mar. 1970
(NLL-M-20580-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A brief history of research on atomic nuclei and isotopes is presented. Technological developments in neutron irradiation, thermonuclear reactions, and the synthesis of super elements are included. J.M.

N71-37253 National Lending Library for Science and Technology, Boston Spa (England).
COEFFICIENT OF BACKSCATTER IN THE CASE OF MONOKINETIC ELECTRONS STRIKING A TARGET AT AN OBLIQUE ANGLE
F. Amal et al 11 May 1971 7 p refs Transl. into ENGLISH from Comptes rend., Ser. B (Paris), v. 268, no. 23, 1969 p 1526-1529
(NLL-CE-Trans-5532-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The coefficient of backscatter with solid specimens, bombarded at an oblique angle by a parallel beam of monokinetic electrons was obtained simply from the relationships defining the transmission coefficient of the electrons through thin layers of the material. Agreement between the theoretical and experimental values is considered satisfactory. Author

N71-37254 Duke Univ., Durham, N.C.
STATISTICAL DYNAMICS OF QUANTUM OSCILLATORS, PARAMETRIC AMPLIFICATION IN A SINGLE MODE, AND RELATED TOPICS
Maurice Terrell Relford (Ph.D. Thesis) 1969 180 p
Avail: Univ. Microfilms Order No. 70-18093

A general formalism is presented for describing nonlinear interactions of radiation with matter in terms of the properties of quantum oscillators. Solutions of Heisenberg's equations of motion for the boson annihilation and creation operators associated with particular radiation field modes are used to determine the time evolution of an appropriate quantum mechanical distribution function. The P-distribution is discussed briefly. The Wigner distribution is presented as an alternative and equally convenient distribution function which always exists. General formulas and theorems are derived for the time evolution of the Wigner distribution and for the average values of observables. The general formalism is applied to the process of parametric amplification in a single mode. Related problems concerning two- and three-level atoms and charged particles in a magnetic field are also considered. Dissert. Abstr.

N71-37255 Rochester Univ., N.Y.
CONTRIBUTIONS OF INELASTIC CHANNELS TO THE PION'S ELECTROMAGNETIC FORM FACTOR, PART 1. PRODUCTION OF STRANGE PARTICLES IN PROTON-PROTON SCATTERING, PART 2
Salvatore Serio (Ph.D. Thesis) 1970 104 p
Avail: Univ. Microfilms Order No. 70-17808

It is shown that inelastic pion-pion scattering appreciable contributes to the electromagnetic form factor of the pion. The effect of inelasticity is computed by solving the dispersion relation for the pion form factor in the multichannel formalism with a suitable approximation for the left hand cut. The reactions pp-YKN are studied under the hypothesis of a dominant contribution from the exchange of a pseudoscalar meson between the initial protons. A simple multiplicative cut-off function is used to describe the various damping effects at large momentum transfer. It is found that the agreement with the experimental data is fairly good, within the limits of the model. Dissert. Abstr.

N71-37256 Tufts Univ., Medford, Mass.
RECOIL PROTON POLARIZATION FROM NEUTRAL PION PHOTOPRODUCTION ON HYDROGEN IN THE ENERGY RANGE FROM 1200 TO 1800 MeV
Nobuyuki Tanaka (Ph.D. Thesis) 1969 280 p
Avail: Univ. Microfilms Order No. 70-18113

The experiment was performed at a 6 GeV alternating gradient electron synchrotron. A large carbon-plate spark chamber was utilized for the measurement of scattering asymmetry and range. A total of approximately 180,000 events in the incident photon energy range of 900 to 1800 MeV were recorded on film. The polarization values were calculated by a maximum-likelihood method using existing analyzing power data for proton-carbon scattering. Analysis was done on a portion of such events for incident photon energies above 1200 MeV. The results indicate that the polarization changes sign from negative to positive values around 1300 MeV photon energy. The steep variation of polarization as a function of the center-of-mass angle was confirmed. Dissert. Abstr.

N71-37257 Washington Univ., Seattle.
MEASUREMENTS OF PROTON-PROTON BREMSSTRAHLUNG AT 20 MeV
Derek Walton Storm (Ph.D. Thesis) 1970 125 p
Avail: Univ. Microfilms Order No. 70-19863

Cross section measurements were made for proton-proton bremsstrahlung, with 20-MeV incident proton energy, detecting the protons in coincidence at 25 deg on either side of the beam and at 30 deg on either side of the beam. The photon angular distributions, and the photon energy spectra were also determined. The experimental techniques are standard, except that a method was developed for reducing the pileup effects due to a high counting rate of elastically scattered particles. This technique enabled us to maintain fairly good (75 KeV) resolution in the proton counters in spite of a 3 x 10,000 count/sec counting rate. Dissert. Abstr.

N71-37258 Tufts Univ., Medford, Mass.
APPLICATION OF REGGE POLE THEORY TO LARGE ANGLE POSITIVE PION PHOTOPRODUCTION
Christine Solomonidou (Ph.D. Thesis) 1969 126 p
Avail: Univ. Microfilms Order No. 70-17394

The nucleon and N Regge poles and an even signature fixed pole at J = -1/2 are used to obtain a fit to the differential cross-section of the photoproduction of positive pions off nucleons at large angles, at 4.3 GeV, 6.7 GeV, 9.8 GeV. With the same parametrization an agreement is obtained with the magnitude but not the shape of the differential cross-section for neutral pion photoproduction at large angles at 12 GeV. Dissert. Abstr.

N71-37259 Arizona Univ., Tucson.
THE DEVELOPMENT OF A POLARIZED ION SOURCE
Winfield Scott Smith, III (Ph.D. Thesis) 1970 102 p
Avail: Univ. Microfilms Order No. 70-19863

A source of polarized protons and deuterons has been built for use on a six-million-volt Van de Graaff accelerator. This source, operating on atomic beam principles, utilizes an RF discharge for hydrogen (deuterium) dissociation, a permanent multipole magnet for atomic state selection, an adiabatic fast passage transition unit, and a high field solenoidal lamber. A new two-frequency, adiabatic fast passage transition unit has been developed for use on deuterium. The two-frequency technique has the advantage of using the same tapered-pole magnet and RF loop as used for the usual single frequency transitions in hydrogen. In addition, a new type of high field solenoidal lamber is described, which utilizes an electron gun to inject electrons into the ionization region, resulting in a considerable power saving. Dissert. Abstr.

N71-37260 Pittsburgh Univ., Pa.
THEORY OF DEUTERON BREAKUP IN NUCLEAR AND COULOMB FIELDS

Frank John Rybicki (Ph.D. Thesis) 1970 128 p
Avail: Univ. Microfilms Order No. 70-18365

The model for the breakup can be thought of as inelastic scattering in which the bound deuteron is excited into an unbound state. The interaction responsible for this excitation is the sum of the neutron-nucleus and the proton-nucleus and the proton-nucleus optical model potentials. The final state wave function is a product of a deuteron optical model wave function and of an unbound deuteron wave function. The theory is compared to experimental breakup cross sections of 12 and 17 MeV deuterons on gold and of 12 MeV deuterons on rhodium. The theory is in disagreement with experiment. For the experiments studied, this disagreement is attributed to the treatment of the proton-nucleus Coulomb interaction in the final state. The methods developed for handling the long range tail of the Coulomb interaction are directly applicable to distorted wave Born approximation calculations of inelastic scattering in which Coulomb excitation cannot be neglected. Dissert. Abstr.

N71-37261 Virginia Polytechnic Inst., Blacksburg.
NEUTRON ACTIVATION ANALYSIS USING MONOENERGETIC GAMMA-RAY SPECTRA
Edgar Larry Robinson (Ph.D. Thesis) 1970 72 p
Avail: Univ. Microfilms Order No. 70-19189

Computer programs for performing both qualitative and quantitative neutron activation analysis using monoenergetic gamma-ray spectra have been developed. The qualitative analysis is based on the spectrum stripping technique. The quantitative analysis is based primarily on the absolute calibration of the counting system; however, the comparator technique can be used with the present program. The methods used are described and a test case is presented to illustrate the use and capability of the programs. Dissert. Abstr.

N71-37262 California Univ., Berkeley.
VECTOR CURRENTS AND CURRENT ALGEBRA IN A ZERO WIDTH MODEL
Richard Comfort Brower (Ph.D. Thesis) 1969 158 p
Avail: Univ. Microfilms Order No. 70-13021

The S matrix for photon and vector current processes is considered directly in terms of Lorentz covariance, analyticity, crossing, Regge asymptotics, and consistency with a dual, zero-width model for the hadron bootstrap. The direct use of local field and current operators is avoided, although occasionally consistency with the results of current algebra is imposed. Since only limited use of unitarity is made, no determination of the ultimate redundancy or inconsistency of the results of current algebra with the unitary S matrix can be made. The covariant photon amplitude is proved to be the smooth limit of the helicity amplitude for a massive vector boson. Amplitudes for one or two vector currents and an arbitrary number of spinless hedrons are considered. Here the investigation of the properties of vector currents consistent with the hadron bootstrap assuming duality and zero resonance widths is begun. A simple N-point beta function model (generalized Veneziano model) of the hadron bootstrap is assumed and the properties of vector currents consistent with it are investigated. Dissert. Abstr.

N71-37263 Houston Univ., Tex.
NUCLEATION OF CAVITATION BY ALPHA PARTICLE IRRADIATION OF LIQUID HELIUM
John Russell Shadley (Ph.D. Thesis) 1970 147 p
Avail: Univ. Microfilms Order No. 70-18024

A review is given of cavitation in normal liquids and liquid helium, vortex and radiation induced cavitation, and the creation of vortex rings in helium II by ions. The presence of an alpha source in the vicinity of the sound field is shown to markedly reduce the cavitation threshold in helium II while having no discernable effect in helium I. Furthermore, neither the presence of a beta source, nor electric fields affect the nucleation. Several similarities can be observed, however, to the behavior of the threshold in the presence of a rotating shaft. It is concluded that the threshold lowering is not due to the formation of microbubbles at hot spots as in the Seitz theory, or ions, but rather to the formation of vortices by the alpha particles. A clear demonstration of the existence of two distinct regions of audible cavitation, hissing and popping, are provided by graphic records of the cavitation noise, along with evidence for the existence of a hysteresis effect in the incipient and desinent step thresholds associated with the popping noise. Dissert. Abstr.

N71-37264 Pennsylvania State Univ., University Park.
ANALYSIS OF MODERATE-ENERGY NUCLEON-NUCLEON DATA
Neil Richard Yoder (Ph.D. Thesis) 1969 95 p
Avail: Univ. Microfilms Order No. 70-19492

A faster minimization technique is developed for phase shift analysis and potential searches. This procedure uses a linear approximation to the data as a function of the search parameters when the vector to the minimum chi squared is calculated. The application to the analysis of nucleon-nucleon scattering data of such statistical criteria as standard deviations, chi squared test, F test, and Chauvenet's criterion is discussed. Phase shift analyses of pp and np scattering data are done using the methods described. Ordering of the phase shifts used as search parameters is studied. Charge splitting of the 1S0 phase at 210 MeV is found to be indeterminate. The nucleon-nucleon potential is discussed. Charge symmetry and charge independence in the zero-energy limit of scattering is studied. Calculations of scattering length, pp bremsstrahlung, and the binding energy of nuclear matter are shown from qualitatively different but phase-equivalent potentials. An energy-dependent representation of the phase shifts is used for comparison with models. Dissert. Abstr.

N71-37265 California Inst. of Tech., Pasadena.
THE O-16(ALPHA, GAMMA)Ne-20 AND Si-28 (ALPHA, GAMMA)S-32 REACTIONS AT LOW ENERGY
James Waldo Toevs (Ph.D. Thesis) 1970 136 p
Avail: Univ. Microfilms Order No. 70-18047

The Si-28(alpha, gamma)S-32 and O-16(alpha, gamma) Ne-20 reactions were investigated to provide data for the calculation of the stellar rates of these reactions. The gamma rays were counted with a NaI(Tl) detection system having a high detection efficiency which is approximately independent of the gamma-ray cascade structure of a nuclear level. The reaction Si-28(alpha, gamma)S-32 was studied for He(+) bombarding energies from 1.4 to 2.7 MeV, and in this region, five new resonances were found, and their strengths were measured. An upper limit for the cross section was also established for bombarding energies below 1.7 MeV. The O-16(alpha, gamma)Ne-20 reaction was investigated in the energy region from 0.85 to 1.8 MeV; strengths for the previously known resonances were measured, and an upper limit for the cross section was determined for energies below 1 MeV. Stellar interaction rates and photodisintegration rates were calculated from the measured resonance strengths. Dissert. Abstr.

N71-37266 Duke Univ., Durham, N.C.
NEUTRON POLARIZATION IN (LC3)D,N) AND (He-3,n) STRIPPING REACTIONS ON LOW-A NUCLEI
Richard Sumner Thomason (Ph.D Thesis) 1969 186 p
Avail: Univ. Microfilms Order No. 70-18101

Angular distributions of the neutron polarizations were measured for the n0 and n1 groups from the Li-6(d,n) and Li-7(d,n) reactions for deuteron energies from 2.5 to 3.8 MeV; for the n0, n1, and unresolved (n2 + n3) groups from the Be-9(He-3,n) reaction for He-3 energies from 2.1 to 3.9 MeV; and for the n0 groups for the B-11(He-3,n) and the C-13(He-3,n) reactions from 3.0 to 3.8 MeV. Targets were used that were generally about 200 keV in thickness to the incident ions. Helium was used as a polarization analyzer and a spin precession solenoid was used to simulate interchange of the 'side' detectors. Data was accumulated by use of an automatic routine under control of an on-line computer. A computer code was written for use in the extraction of polarization asymmetries

from unresolved peaks in gated helium recoil spectra, and this code was used in the analysis of most of the reactions studied.
Dissert. Abstr.

N71-37267 Louisiana State Univ., Baton Rouge.
THE LOW-LYING STATES OF A SYSTEM OF POLARONS IN THE LANDAU-PEKAR ADIABATIC APPROXIMATION
James Lloyd Edwards (Ph.D. Thesis) 1970 62 p
Avail: Univ. Microfilms Order No. 70-18526

An effective interaction potential for a pair of polarons is derived in a Landau-Pekar adiabatic approximation. The possiblity of formation of bound states of two polarons is discussed. The low-lying energy states of a system of Landau-Pekar polarons interacting with the derived effective potential are investigated by employing approximation models including a body-centered cubic lattice of polarons, a Hartree-Fock gas of polarons, and a Hartree-Fock gas of polarons weakly coupled to a polaron plasma. The low-lying energy states based on these models are examined numerically for a specific test case intended to describe polarons in an ionic crystal with a polaron coupling constant large enough that the Landau-Pekar approximation may be expected to be appropriate. It is found that, for a wide range of polaron densities, the plasma-coupled gas model yields the best results among the models treated. Dissert. Abstr.

N71-37268 Purdue Univ., Lafayette, Ind.
THE INTERACTION PICTURE FOR GRAVITY INTERACTING WITH FERMIONS
Michel Charles Vincent Bergere (Ph.D. Thesis) 1970 286 p
Avail: Univ. Microfilms Order No. 70-18595

The interaction between gravitons and fermions is described by a Lagrangian function of the tetrad field and of the fermion field. It is more convenient to use the tetrad field instead of the metric field to describe the interaction because of the use of tetrads in the formulation of the fermion Lagrangian density in curved space. A canonical formalism is developed defining field momenta and Hamiltonian operators on a spatial three-hypersurface. The dynamics of the system is given by the commutators of the fields and momenta with the Hamiltonian. The free-graviton field is defined as the tetrad field of a linear theory of gravitation, and the free-fermion field is given by the fermion Lagrangian of special relativity. Then, the total Hamiltonian is split into the free-field Hamiltonian and an interaction Hamiltonian which is responsible for the nonlinear self-interactions between gravitons. Dissert. Abstr.

N71-37269 Stanford Univ., Calif.
TUNABLE STIMULATED OPTICAL EMISSION FROM POLARITON MODES
Joe Michael Yarborough (Ph.D. Thesis) 1970 115 p
Avail: Univ. Microfilms Order No. 70-18510

The general phenomenon are considered of nonlinear photon-phonon interactions in crystals where the frequency of one of the interacting waves is near a lattice resonance with which it is coupled. The coupled system of the lattice mode and the electromagnetic wave is called a polariton mode. Polariton modes can be used to produce far infrared radiation. When laser photons of frequency are scattered from polariton modes, polaritons with far infrared wavelengths are produced, thus producing far infrared radiation at the polariton, or idler frequency. The rest of the energy of the pump photon goes into a photon at the so-called Stokes or signal frequency. The theory is applied specifically to the case of polariton modes in $LiNbO_3$ which vibrate parallel to the crystalline c from the lowest frequency mode at 248 cm has sufficiently large gain that ordinary Fresnel reflection from the crystal surfaces provides a sufficient resonator to enable the production of stimulated Stokes and idler radiation. Dissert. Abstr.

N71-37270 Miami Univ., Fla.
APPROACH TO EQUILIBRIUM OF INFINITE CHAINS OF COUPLED HARMONIC OSCILLATIONS
Manuel Andres Huerta (Ph.D. Thesis) 1970 146 p
Avail: Univ. Microfilms Order No. 70-18153

Finite segments of infinite chains of classical coupled harmonic oscillators are treated as models of thermodynamic systems in contact with a heat bath, and canonical ensembles. The Liouville function rho for the infinite chain is reduced by integration over the outside variables to a function rhoN of the variables of the N-particle segment. RhoN is calculated from the exact dynamics of the infinite chain and the statistical knowledge of the coordinates and moments at $t=0$; rhoN is a time-dependent probability distribution in the 2N-dimensional phase space of the system. A Gibbs entropy is defined in terms of rhoN. Three types of chain are considered, types 1,2, and 3. In type 3 new mathematical functions are found and their properties are developed. The chain of type 1 is found to exhibit Brownian motion. For all the chains two different types of initial conditions are used; they lead to state of canonical and noncanonical equilibrium. Dissert. Abstr.

N71-37271 Purdue Univ., Lafayette, Ind.
ANALYSIS OF A MODEL OF CONDENSATION FOR FERMI SYSTEMS
Hugh Lawrence Scott, Jr. (Ph.D. Thesis) 1970 60 p
Avail: Univ. Microfilms Order No. 70-18730

The behavior of a model of phase transitions in Fermi systems developed by Gartenhaus and Stranahan is analyzed in the region near the critical point. For a wide range of two body interactions it is shown that the model offers a description of the critical region analogous to that given by the classical theory of van der Waals. The model is also extended to take into consideration certain analytic forms for three-body and higher interactions, and it is found that the model is again equivalent to the classical theory. By using a slightly nonanalytic form for the many body interactions a nonclassical description of the critical region is obtained. The nonclassical system is then applied phenomenologically to He-3 near its critical point and the resulting model is compared with recent experimental data.
Dissert. Abstr.

N71-37458# Academy of Sciences (USSR), Moscow.
EFFECT OF CHARGED PARTICLE CAPTURE BY A MAGNETIC FIELD, WITH IONIZATION LOSS
D. Kh. Morozov *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 212-214 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

N71-37466# Academy of Sciences (USSR), Moscow.
APPLICATIONS OF METHODS OF MEASURING SMALL AND TRACE QUANTITIES OF DIFFERENT ISOTOPES TO ASTROPHYSICAL STUDIES
V. O. Naydenov *In* its proc. of the 6th Ann. All-Union Inter School on Space Phys., Part 1 1969 p 281-287 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

N71-37469# Academy of Sciences (USSR), Moscow.
PROTON DISTRIBUTION IN AN EXTERNAL REGION IN THE VARIABLES MU, L
Yu. I. Guber and V. P. Shabanskiy *In* its Proc. of the 6th Ann. All-Union Wintar School on Space Phys., Part 1 1969 p 269 In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

N71-37471# Academy of Sciences (USSR), Moscow.
A COMPARISON OF VARIATIONS IN ENERGETIC ELECTRONS AND ULTRALOW FREQUENCY RADIATION
A. B. Mistyshev, P. M. Svidskiy, V. A. Burov, I. G. Klaymenova, and V. A. Troitskaya *In* its Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 273 In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

N71-37475# Academy of Sciences (USSR), Moscow.
POSSIBILITY OF UTILIZING ELECTRIC FIELDS IN SPACE FOR RADIATION PROTECTION FROM PROTONS AND ELECTRONS
T. Ya. Ryabova and K. A. Trukhanov *In* its Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 277-278 In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N71-37272# United Kingdom Atomic Energy Authority, Culham (England).
EXPERIMENTS WITH A LINEAR L EQUALS 1 HIGH-BETA STELLARATOR ON ISAR I
M. Kaufmann et al Nov. 1970 29 p refs Transl. into ENGLISH from German report IPP-1/111, Aug. 1970
(CTO-742; IPP-1/111) Avail: AEC Depository Libraries

In preparation for a toroidal high-beta stellarator, a linear experiment with helical l = 1 symmetry was made on the ISAR-1 theta pinch. The fast theta-pinch-like shock heating in the presence of a helical field and the buildup of a plasma column were investigated. It could be seen that the plasma formed a screw near the axis of the vacuum magnetic field. Neither rapidly growing instabilities nor enhanced diffusion was found.
Author (NSA)

N71-37273# Democritus Nuclear Research Center, Athens (Greece).
RELATIVISTIC DOPPLER EFFECT AND GROUP VELOCITY IN HOMOGENEOUS NONLINEAR AND INHOMOGENEOUS PLASMA
J. S. Nicolis and E. Athanassoula 1971 39 p refs
(DEMO-71/6) Avail: AEC Depository Libraries

The variations of the received frequencies (complex Doppler effect) from a source moving uniformly in a homogeneous isotropic plasma and emitting a uniform electromagnetic plane wave with amplitude E sub 0, as a function of omega sub e/E sub 0 where omega sub e is the plasma frequency, are studied. The ratio of the velocity U of the source over the group velocity U sub gr of the transmitted wave is then calculated from the slope of the Doppler curves. When the plasma is inhomogeneous (one-dimensional stratification) the Doppler effect depends on the particular profile of the refractive index and its higher (even) derivatives with respect to the direction of stratification z. In this case, the ratio U/U sub gr = f(z) is given as the solution of a higher-order differential equation, with the inhomogeneous part depending on the slope of the Doppler curve with respect to frequency. Typical cases involving symmetrical and transition profiles are examined.
Author (NSA)

N71-37274# Democritus Nuclear Research Center, Athens (Greece). Physics Dept.
GROUP VELOCITY OF HIGH AMPLITUDE SURFACE WAVES IN VACUUM-PLASMA INTERFACES
J. S. Nicolis and E. Athanassoula Mar. 1971 6 p refs
(DEMO-71/5) Avail: AEC Depository Libraries

The behavior of the refractive index and group velocity for strong electromagnetic surface waves propagating along a vacuum-overdense plasma plane interface is investigated.
Author (NSA)

N71-37276# Atomic Energy Establishment, Cairo (Egypt). Dept. of Accelerators and Plasma Physics Research.
DESIGN AND CONSTRUCTION OF A SINGLE GAP HIGH GRADIENT COLUMN
M. E. Abdelaziz 1969 28 p refs
(UARAEE-87) Avail: AEC Depository Libraries

A design study for a single-gap, high gradient acceleration column to be used as a high current injector supplying a pulsed 300 KeV beam of 200 mA protons is described. The facility, when completed, will be utilized in plasma ignition to a high temperature. The high current injector will be also used in the study of improved beam quality, or so-called beam emittance, due to the effect of reduced space charge forces resulting from high gradient acceleration. This problem is of vital importance when considering beam injection from an accelerator of given acceptance. The emittance-acceptance matching is a necessity in the development of accelerators capable of accepting a large proportion of the injected beam.
Author (NSA)

N71-37276# Atomic Energy Establishment, Cairo (Egypt). Dept. of Accelerators and Plasma Physics Research.
STUDY OF ELECTROMAGNETIC SURFACE WAVES IN ADJACENT PLASMA FLOWS
A. M. Hussein and V. I. Pakhomov 1970 35 p refs
(UARAEE-97) Avail: AEC Depository Libraries

A dispersion equation describing electromagnetic waves that propagate along a plane boundary of contiguous plasma streams was obtained. The external magnetic field is parallel to the unperturbed velocities of the streams and is homogeneous in the whole space. In the general case, the plasma streams are relativistic ones. The longitudinal thermal motion of the plasma particles is taken into consideration. In the direction perpendicular to the boundary the thermal motion of the particles is supposed to be absent. Thus, the present investigation is applicable for the oscillations whose transverse wavelength is much larger than the Larmor radius of particles with velocities V sub T perpendicular. The excitation of surface waves in the half-bounded plasma by the adjacent beam of charged particles was investigated in detail. The expressions for the amplification coefficients, both for the case of the cold beam and for the beam with great spread of the longitudinal particle velocities, were obtained.
Author (NSA)

N71-37277# Atomic Energy Establishment, Cairo (Egypt). Dept. of Accelerators and Plasma Physics Research.
AXIALLY SYMMETRIC WAVES IN VACUUM CHANNEL IN PLASMA
V. I. Pakhomov and H. M. Rizk 1970 31 p refs
(UARAEE-92) Avail: AEC Depository Libraries

Axially symmetric electromagnetic waves propagating along a round cylindrical vacuum channel in an unbounded magnetoactive plasma are investigated. The external magnetic field is parallel to the channel axis. The general dispersion equation is obtained. For some specific cases (the absence of the external magnetic field, the infinite magnetic field, quasi-static approximation) a detailed investigation of the dispersion equation is made.
Author (NSA)

N71-37278# Atomic Energy Establishment, Cairo (Egypt). Dept. of Accelerators and Plasma Physics Research.
STUDY OF LONGITUDINAL NONLINEAR OSCILLATIONS OF A HOT ELECTRON MAGNETIC PLASMA
I. A. El-Naggar 1970 20 p refs
(UARAEE-88) Avail: AEC Depository Libraries

Longitudinal nonlinear oscillations of a hot electron plasma in the presence of an external magnetic field were investigated by applying Krylov-Bogolyubov-Mitropolskii perturbation method. The second harmonic was added to the solution of the linear problem in the first approximation. The expressions for frequency and wavenumber shifts were derived from the second approximation.
Author (NSA)

N71-37279# Atomic Energy Establishment, Cairo (Egypt). Dept. of Accelerators and Plasma Physics Research.
STUDY OF DYNAMICS OF THE THETA-PINCH DISCHARGE WITH A SUPERIMPOSED AZIMUTHAL

MAGNETIC FIELD
T. A. El-Khalafawy, A. M. Youssef, V. G. Diatlov, and Ve. F. Volkov 1970 26 p refs
(UARAEE-102) Avail: AEC Depository Libraries

A magnetohydrodynamic steady-flow model, on the assumption of ideal plasma conductivity, is used for the theoretical consideration. The pressure balance with the inclusion of the time variations of the external, trapped, and azimuthal magnetic fields is considered in order to estimate the discharge radius. The plasma radial oscillations are shown to be of a magnetohydrodynamic nature. Its period is of the order of the ion-ion self-collision time. The measurements of an axial electric polarization and the azimuthal magnetic field made it possible to determine the discharge boundary motion velocity and that of any inner plasma layer. High-speed photographic techniques were also used. Author (NSA)

N71-37280# Atomic Energy Establishment, Cairo (Egypt). Dept. of Accelerators and Plasma Physics Research.
EXPERIMENTAL STUDIES ON SHOCK WAVES PROPAGATED THROUGH A LONGITUDINAL MAGNETIC FIELD IN ELECTRODELESS DISCHARGE TUBES
H. M. Mahmoud, T. A. El-Khalafawy, M. M. Masoud, M. S. El-Gwaily, and Ya. Volkov 1970 40 p refs
(UARAEE-101) Avail: AEC Depository Libraries

A microwave-reflection method is applied to study the interaction mechanisms of shock waves propagated through an axial external magnetic field. It is found that the velocity damping factor alpha(B) increases linearly with increasing uniform magnetic fields according to the relation alpha = aH where a approximately equals 0.25 per kg. The microwave-interferometer method was used to determine the average electron density distribution; the maximum electron density measured approaches a value of 1.7 x 10 to the 13th power/cu cm, which represents the theoretical cutoff density. The above microwave methods are used in the Q-band range (8 mm wave length). A double electrical probe (Langmuir probe) is used to determine the density within the shock front and its variation with the external magnetic field along the tube axis. It is found that the shock front density decreases with increasing magnetic field in both positive and negative directions, only in the region where B is variable it also decreases with increase of distance. The plasma is produced by electromagnetically driven shock waves in hydrogen gas at pressure of 70 m torr. The velocity reaches a value of 1,000,000 cm/sec. A superimposed axial magnetic field of intensity 8.7 kg is applied to the path of the shocks. Author (NSA)

N71-37281# Atomic Energy Establishment, Cairo (Egypt). Dept. of Accelerators and Plasma Physics Research.
EXPERIMENTAL STUDIES ON MAGNETICALLY DRIVEN SHOCK WAVE PASSING THROUGH A LONGITUDINAL MAGNETIC FIELD
T. A. El-Khalafawy, Ya. F. Volkov, M. F. El-Menshawy, M. M. Masoud, and M. A. El-Masry 1970 40 p refs
(UARAEE-106) Avail: AEC Depository Libraries

The main interest is focused on studying the effect of an external magnetic field on the shock wave produced by a conical pinch discharge of peak current 250 kA, charging voltage = 20 kV and time of half cycle 1.8 microsec. The external magnetic field of 6.8 kG is produced by capacitor bank (charging voltage 10 kV and time of half cycle 1 m sec). The shock-wave capacitor bank is fired near maximum magnetic field. Hydrogen gas is used at initial pressure 70 m torr, and the shock wave produced has maximum velocity 10 to the 7th power cm/sec. The analysis of the variation of shock wave velocities due to the presence of a magnetic field shows that the propagation factor of the shock-wave is proportional linearly with the magnitude of the constant axial magnetic field and to the square of the gradient magnetic field. The magnetic probe measurement shows the presence of a rotating current within the front, which is also a source of energy given to the front within propagation. Author (NSA)

N71-37282# Atomic Energy Establishment, Cairo (Egypt). Dept. of Accelerators and Plasma Physics Research.
BOUNDARY CONDITIONS IN THE CASE OF ADJACENT PLASMA STREAMS
I. A. El-Negger, V. I. Pekhomov, and K. E. Zayed 1969 26 p refs
(UARAEE-78) Avail: AEC Depository Libraries

The comprehensive and rigid derivation of boundary conditions for adjacent streams of cold plasma in the presence of an external magnetic field is carried out. The cases of plane and cylindrical geometries are considered. Expressions are obtained for the dielectric permeability tensor-operator components for cold inhomogeneous plasma in the presence of a certain profile of the equilibrium particle velocities. Author (NSA)

N71-37283# Atomic Energy Establishment, Cairo (Egypt). Dept. of Accelerators and Plasma Physics Research.
USE OF A CONTROL COMPUTER FOR THE ANALYSIS AND MEASUREMENT OF BEAM QUALITY IN A 50-MeV ACCELERATOR
M. E. Abdelaziz 1969 17 p refs
(UARAEE-76) Avail: AEC Depository Libraries

A multiplexed ADC and a high-speed buffering system linked to a control computer are used in a new technique to analyze and study the beam quality, or so-called beam emittance, of the 50-MeV proton linear accelerator (linac) that is used as injector for the Zero Gradient Synchrotron (ZGS) at Argonne National Laboratory. This method permits beam sampling at a speed of one microsecond such that phase-space variations during the beam pulse as well as pulse-to-pulse variations can be detected. Beam profiles can also be obtained both from computer stored data and from oscilloscope traces. Author (NSA)

N71-37284*# Washington Univ., Seattle.
LASER HEATING OF A STATIONARY PLASMA
Loren Clifford Steinhauer (Ph.D. Thesis) 1970 244 p refs
(Grants NGR-48-002-044; NSF GK-20708)
(NASA-CR-122087) Avail: NTIS CSCL 20I

Heating of plasma by laser beams is discussed. The plasma is taken to be a one dimensional, fully ionized gas being irradiated by a laser of wavelength lambda sub zero normal incidence. The initial density and temperature profiles are arbitrary to the extent that a fully ionized gas is a valid assumption. The plasma is assumed to be a dense ideal gas mixture of electrons and ions such that there is charge neutrality at every point for all times. Author

N71-37285*# Colorado Univ., Boulder. Dept. of Electrical Engineering.
NON-RECIPROCAL DEVICES USING SOLID STATE MAGNETOPLASMAS AT MILLIMETER AND SUBMILLIMETER WAVELENGTHS
Motohisa Kanda Jul. 1971 169 p refs
(Grant NGL-06-003-068)
(NASA-CR-122923) Avail: NTIS CSCL 20I

A study of a 94 GHz waveguide isolator is presented which consists of an annular InSb column in a circular waveguide with a longitudinal dc magnetic field and is operated at 76 K. In a mode matching analysis the characteristic equation is solved in order to determine the propagation constants in the waveguide with the annular InSb column. The attenuation constant was then calculated by matching the fields at the ends of the plasma column. A study of reflection beam isolators at millimeter and submillimeter wavelengths is also presented using the non-reciprocal behavior in solid state magnetoplasmas at room temperature. Two geometries are considered: GaAs-dielectric interface at 94 GHz and a free space-dielectric coated InSb interface for submillimeter wavelengths (337 micrometers). A physical explanation for the nonreciprocal reflection based on the electron orbits in the plasma is presented. Author

N71-37286*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RESONANT DIFFUSION IN THE PRESENCE OF STRONG PLASMA TURBULENCE
T. J. Birmingham and M. Bornatici (European Space Res. Inst.) Aug. 1971 27 p refs Submitted for publication
(NASA-TM-X-65693; X-641-71-320) Avail: NTIS CSCL 20I

The diffusion equation which describes the evolution of the average one particle distribution function for an ensemble of strongly turbulent plasmas is derived. The diffusion tensor is a time integral of the autocorrelation tensor of the fluctuations as observed by particles moving along statistically distributed orbits. These orbits contain the effects of fluctuations and thus differ from those encountered in weak turbulence theory. Two statistical orbit effects quadratic in the strength of the fluctuations affect the magnitude of the diffusion: (a) modification of the ensemble average orbits by the flucuations and (b) statistical dispersion in particle orbits about the average. The plasma trajectory equations are used to relate each to the diffusion tensor itself when the turbulence is electrostatic. The diffusion tensor is explicitly evaluated for a strongly turbulent unmagnetized plasma. Author

N71-37287# Academy of Sciences (USSR), Leningrad. Fiziko-Tekhnicheskii Inst.
RESEARCH ON ULTRA-HIGH FREQUENCY HEATING AND ADIABATIC COMPRESSION OF A PLASMA IN THE TUMAN-2 FACILITY
A. I. Anisimov, N. I. Vinogradov, V. E. Golant, V. A. Ipatov, M. G. Kaganskii et al 17 Jun. 1971 23 p refs In RUSSIAN Presented at the 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17-23 Jun. 1971
(Conf-710607-141; CN-28/L-5) Avail: AEC Depository Libraries

Experiments conducted in the recently constructed toroidal device Tuman-2 are described. The toroidal discharge chamber of the device has a major radius of 80 cm and a minor radius of 20 cm. The strength of the quasi-stationary magnetic field can be varied up to 10 kOe (pi - 10 ms). Provision is made in the device for three-stage heating of the plasma. The first stage comprises ohmic heating in conditions similar to those prevalent in Tokamaks, the second stage heating with UHF fields, and the third stage adiabatic compression. Ultra-high-frequency heating is effected by means of generators operating in frequency bands of approximately 10 and 40 Gc with an output of up to 100 kW at a pulse duration of 100 microseconds. Adiabatic compression is brought about by strengthening the longitudinal magnetic field for periods shorter than the transverse diffusion time (70 to 100 microseconds). At the present stage of the experiment, the maximum contracting field is 15 kOe. Author (NSA)

N71-37288# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Sukumi (USSR). Fiziko-Tekhnicheskii Inst.
CIRCUITS FOR STUDYING INTERACTIONS OF HIGH FREQUENCY FIELDS WITH PLASMA IN LINEAR INSTALLATIONS
I. S. Savchenko and I. R. Yampolskii 1970 27 p refs In RUSSIAN
(INP-15888) Avail: AEC Depository Libraries

Circuit diagrams are given for forming high frequency fields in plasma experimental installations with cylindrical discharge chambers. The structure of transverse rotating fields with various number of poles (p - 0,1 and 2) is discussed. The structure consists of eight rods distributed uniformly along the generating cylinder, which are attached separately to the capacitor bank according to the scheme of a simulated delay line enclosed in a ring or as a separate magnetically coupled circuit. The suggested schemes can be excited by a four phase voltage source, which results in highly symmetric fields. The circuits can be excited simultaneously at two frequencies. Moreover, each frequency matched to a specific pole number p. Formulas were obtained for determining the main parameters, and some data are given for practical implementation of the circuits. Author (NSA)

N71-37289# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
COMPUTER SIMULATION OF ANOMALOUS RESISTANCE
D. Biskamp and R. Chodura 17 Jun. 1971 9 p refs Presented at the 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17 Jun. 1971
(Conf-710607-65; CN-28/E-17) Avail: AEC Depository Libraries

The current-driven ion-sound instability is investigated by two dimensional computer experiments for three different cases: (1) j is perpendicular to B sub 0 (j - current density, b sub 0 - static magnetic field), (2) B sub 0 - 0; and (3) j parallel to B sub 0. In all cases the ion-sound instability is stabilized by ion trapping. For B sub 0 - or B sub 0 parallel to j, quasi-linear effects on the electron distribution function are present; they reduce the growth rate, especially of modes in the current direction, but do not quench it. No noticeable difference is found between cases 2 and 3, in agreement with results of real experiments. While in case 1 the numerical value of effective nu is consistent with measurements on shock experiments, there seems to be a discrepancy for the other two cases, which originates from the relatively large portion of runaway electrons. This effect is believed to be due to the two-dimensional geometry used and is expected to be much smaller in a fully three-dimensional system. Author (NSA)

N71-37290# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
INVESTIGATION OF LASER PRODUCED PLASMAS IN THE keV TEMPERATURE RANGE
K. Buechl, K. Eidmann, P. Mulser, H. Salzmann, R. Sigel et al 17 Jun. 1971 10 p refs Presented at the 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17 Jun. 1971
(Conf-710607-48; CN-28/D-11) Avail: AEC Depository Libraries

Experimental and theoretical investigations of the problems associated with plasma production by laser radiation of very high intensity are reported. In the experiment, nanosecond and picosecond laser pulses were focused onto plane targets of solid hydrogen and deuterium. Reflection measurements of the laser light were performed. The electron temperature of the plasma was determined from soft X-ray continuum intensity measurements. The spatial distribution of the ions in the expanding plasma, their kinetic energy, and their total number were determined by a set of charge-collecting probes. Neutron production in the plasma was measured with two fast scintillation detectors. The experimental results are compared with numerical calculations, which describe the gasdynamic behavior of laser heated solid deuterium including the effect of heat conduction. Author (NSA)

N71-37291# Nagoya Univ. (Japan). Inst. of Plasma Physics
MASS-ENERGY ANALYSIS FOR HIGHLY IONIZED STEADY STATE PLASMA
Hajime Ishimaru Nov. 1970 67 p refs In JAPANESE
(IPPJ-DT-22) Avail: AEC Depository Libraries

An electrostatic type energy analyser was constructed with energy resolution of 2 to 3% even in the energy region of 10 eV. A time of flight type mass spectrometer was also constructed, which works in combination with the former. Mass resolution of 10 to 30% was attained in this experiment. Fundamental variables of QP plasma were measured, such as energy distribution of ions, ratio of existing ions, etc. Maxwell distribution of the ions was ascertained for the QP plasma. Energy distribution function of the ions was theoretically analyzed and compared with experiment. The ion temperature of 2 to 5 eV was obtained for both H and He plasma. Ions of H(+), H2(+), and H3(+) were found in the hydrogen plasma. Author (NSA)

N71-37292# Scientific Research Inst. of Electro-Physical Apparatus, Leningrad (USSR).
FLUCTUATING ELECTRIC FIELDS IN A TURBULENT

PLASMA
A. S. Berezin, L. S. Dubovoi, and S. V. Lyublin 17 Jun. 1971 18 p refs In RUSSIAN Presented at the 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17 Jun. 1971
(Conf-710807-56; CN-28/E-8) Avail: AEC Depository Libraries

The electric fields occurring in a plasma produced by z discharges with a rapidly alternating current were studied. When a high-frequency or rapidly alternating current flowed through the plasma, a stable skin layer formed in which effective electron and ion heating occurred. The electric field strengths were determined as a function of the discharge parameters and the direction of observation from the broadening of the Balmer series lines of hydrogen. Calculations of the effective values of the electric fields on the basis of Stark broadening of the lines were performed in the quasi-stationary approximation and in an approximation based on broadening due to high-frequency fields at ion-acoustic and Langmuir frequencies. The measurements showed that the fluctuating electric field grows as the axial magnetic field increases. For magnetic fields greater than 1 kG the measured electric fields are at least an order of magnitude stronger than the electric field produced by the applied voltage.
Author (NSA)

N71-37283# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
PLASMA SHIFT IN FAST STELLARATORS WITH FINITE CONDUCTIVITY
D. Pfirsch and A. Schluter 17 Jun. 1971 25 p Presented at the 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17-23 Jun. 1971
(CN-28/H-12; Conf-710807-112) Avail: AEC Depository Libraries

The production of large plasma flows in fast compression stellarators without having the plasma hit the walls is discussed. The case in which there is a vacuum between the plasma and the wall is considered where the plasma has already shifted out of the magnetic surfaces such that no secondary currents can flow along the lines of force. The plasma is then accelerated in a radial direction until the necessary plasma flows are established. An estimate of the resulting total shift of the plasma is given. A second case in which the same finite conductivity exists throughout the volume inside the walls is also considered. An assumption is made that the radial flow of the plasma already exists, permitting the secondary currents to flow. Due to the radial flow, the plasma moves until the flow in the toroidal direction is achieved. The total shift is given. The relations shown make it desirable to use configurations with only small secondary currents, by corrugating the magnetic lines of force to a certain degree.
Author (NSA)

N71-37284# Nagoya Univ. (Japan). Inst. of Plasma Physics.
CONFINEMENT OF A TOROIDAL THETA-PINCH PLASMA IN A PERIODIC CAULKED CUSP FIELD
Taijiro Uchida, Koichi Sato, Akihiro Mohri, and Rivichi Akiyama 17 Jun. 1971 10 p refs Presented at the 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17-23 Jun. 1971
(CN-28/J-1; CONF-710807-113) Avail: AEC Depository Libraries

This caulked cusp field is generated from currents induced by the theta-pinch magnetic field in the metal rings placed, perpendicularly to the main field, inside the discharge tube. The current in the ring is simply inductive, and a closed line of null field lies inside each ring. Owing to the skin effect of the ring conductor, the null field line remains during the discharge. Experiments were carried out on a toroidal machine with a theta-pinch coil of 50-cm major diameter and 13-cm minor diameter, equipped with 24 ceramic-coated metal rings inside. In order to get a favorable result for the confinement of the pinch plasma, there should be a region in which there exists a magnetic field minimum on the midplane between neighboring rings, and the region should correspond to the plasma location at the maximum contraction. The number 24 for the rings is chosen so as to satisfy these conditions and the plasma is really observed to stay at this location.
Author (NSA)

N71-37285# Nagoya Univ. (Japan). Inst. of Plasma Physics.
EXISTENCE CONDITIONS FOR COLLISIONLESS HYDROMAGNETIC SHOCK WAVES ALONG THE MAGNETIC FIELD
Yusuke Kato, Masayoshi Tajiri, and Tosiya Tanuti Mar. 1971 61 p refs Revised Submitted for publication
(IPPJ-106) Avail: NTIS

Existence conditions are investigated for steady hydromagnetic shock waves propagating in a collisionless plasma along an applied magnetic field. The electrostatic waves are excluded. The conditions are based on the requirement that solutions of the Vlasov-Maxwell equations deviate from a uniform state ahead of a wave. They are given as the conditions on the upstream flow velocity in the wave frame, that is, in the form of inequalities among the upstream flow velocity and some critical velocities. The conditions crucially depend on the pressure anisotropy and demonstrate possibilities of exacting collisionless shock waves for high beta plasmas.
Author

N71-37286# California Univ., Livermore. Lawrence Radiation Lab.
PROPOSAL FOR MIRROR FUSION EXPERIMENT (MFX)
7 May 1971 115 p refs
(Contract W-7405-eng-48)
(UCRL-51042) Avail: NTIS

This is a proposal to construct at LRL, Livermore, a large facility for the study of mirror-confined fusion plasmas. The facility, called MFX for Mirror Fusion Experiment, is to be readied for first operation in FY 75. MFX is the successor to the present mirror experiments, 2X II and Baseball II. It has two main goals: (1) to extend mirror confinement studies from their present plasma parameter limits to reactor-like average ion energies and reactor densities and (2) if adequate confinement is achieved, to demonstrate with a reacting plasma all of the essential functions of a mirror-reactor i.e., injection, confinement, and energy recovery.
NSA

N71-37287# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
EXCITATION AND IONIZATION OF IONS BY ELECTRON IMPACT Technical Progress Report, 1 Sep. 1970 31 May 1971
J. W. Hooper, R. K. Feeney, J. C. Majure, and D. McPherson 31 May 1971 34 p refs
(Contract AT(40-1)-3027)
(ORO-3027-19) Avail: NTIS

Development of the microwave transient response technique for magnetoplasma diagnostics is described. Diagrams of the experimental arrangement are shown. An outline of research on energy losses of Li particles in thin films of carbon at incident energies between 2 and 10 keV is presented. Some preliminary data on energy distributions of Li particles emerging from carbon films are included. A survey of possible sources of highly charged ions for collision experiments indicated that the electron-cyclotron source and the hot-electron plasma source merit further study.
NSA

N71-37288# California Univ., Livermore. Lawrence Radiation Lab.
COMPUTATION OF PLASMA EQUILIBRIA AND STABILITY IN ASTRON AND MINIMUM-B MIRROR SYSTEMS
David Vincent Anderson (Ph.D. Thesis) Apr. 1971 112 p refs
(Contract W-7405-eng-48)
(UCRL-51090) Avail: NTIS

For the Astron, the equilibrium equation for the E layer and plasma reduces to a single scalar elliptic equation in two dimensions. The finite-difference form of this equation is solved by the ADI (alternating direction implicit) algorithm. A restriction of this stability analysis is that all toroidal fields vanish. Two

codes were developed for Astron. The first is in cylindrical coordinates, and the second one is in toroidal coordinates. The latter of these is more general than Astron and can treat other configurations such as Tokomak and Levitron. The mirror configurations have open field lines and are generally lacking the symmetry required for a two dimensional representation. The equilibrium equation for tensor pressure reduces to one scalar equation in three dimensions, which is assumed to be elliptic. A generalization of the ADI algorithm is required to solve the finite-difference form of this equation. Stability of the equilibria are checked by the Hastie-Taylor criteria for hydromagnetic stability in the guiding-center theory. The mirror instability places a limit on the maximum plasma pressure. Author (NSA)

N71-37299# Princeton Univ., N.J. Plasma Physics Lab.
VACUUM TUBE COMPENSATED FLAT TOP HIGH-CURRENT PULSE SUPPLY FOR SYMMETRICAL TORUS MACHINE
N. M. Turitzin and H. M. Jr. Chandler Apr. 1971 10 p Presented at the 4th Symp. on Eng. Probl. of Fusion Res., Washington, D. C., 20-23 Apr. 1971
(Contract AT(30-1)-1238)
(MATT-837; Conf-710418-7) Avail: NTIS

The conversion of the Model C stellarator to a symmetrical torus machine produced a longer plasma confinement time. This, in turn, required a longer ohmic heating current pulse than could be supplied by the existing vacuum tube system controlling the total energy flow. A new energy supply, consisting of high-voltage capacitor bank and crowbar coupled with a low-voltage pulse-forming network of electrolytic capacitors, was added in parallel with the existing vacuum tube system such that the two are complementary. The composite supply is capable of producing longer pulses with a greater amplitude and, at the same time, permits modulation of the flat top. Author (NSA)

N71-37300# Princeton Univ., N.J. Plasma Physics Lab.
FLOATING RING STABILIZATION SYSTEM
M. Pelovitz, W. J. Heim, and J. G. Murray May 1971 9 p
(Contract AT(30-1)-1238)
(MATT-839) Avail: NTIS

The necessity of magnetically levitating a superconducting, current carrying ring without mechanical supports requires an electrical stabilizing system. The ring when supported, has only one equilibrium position, which is one of unstable equilibrium. The ring is free to move with up to six degrees of freedom. Two degrees are dictated by the plane of the ring. The ring can be tilted, requiring three more reference points to determine a new plane. The sixth degree of freedom is governed by the ring's ability to rotate on its own axis, but a restoring supply is not provided. Each of the five identical stabilizing supplies has a feedback loop. The position detector element is an optical head that sends a light beam across an optical edge on the ring, the reflection of which is sensed on a photodiode. The diode voltage signal, proportional to the ring position, is the input to an amplifier whose output is a signal proportional to position, velocity, and ring acceleration. The design and construction details of this system are discussed. Author (NSA)

N71-37301# Princeton Univ., N.J. Plasma Physics Lab.
THE OPTICAL SENSORS IN FM-1
V. S. Foote, Jr. May 1971 12 p refs Presented at the 4th Symp. on Eng. Probl. of Fusion Res., Washington, D. C., 20-23 Apr. 1971
(Contract AT(30-1)-1238)
(MATT-840; Conf-710418-10) Avail: NTIS

In the PPL FM-1 Machine, the plasma containment volume is shaped, in part, by a levitated superconducting ring, which is stabilized and positioned by servoed currents in stationary tilt and slide coils. The instantaneous position of the ring is sensed, in the required five degrees of freedom, by external noncontacting reflex optical sensors. Design and construction of these sensors are described, and results of performance tests, both off and on the FM-1, are presented. Author (NSA)

N71-37302# Princeton Univ., N.J. Plasma Physics Lab.
LAWSON CRITERIA
R. G. Mills May 1971 6 p refs Presented at the 4th Symp. on Eng. Probl. of Fusion Res., Washington, D. C., 20-23 Apr. 1971
(Contract AT(30-1)-1238)
(MATT-844; Conf-710418-12) Avail: NTIS

The Lawson criterion is a minimum condition on the product of ion density and mean residence (confinement) time of the energetic ions within a reacting plasma if it is to be useful as a source of thermonuclear power. The criterion is a function of temperature and energy recovery efficiency. The curve originally presented by Lawson, for a single efficiency of 1/3, is actually the lower side of a closed contour in the ion density, temperature plane. There is a forbidden region within which a steady-state reactor cannot operate. The Lawson efficiency should not be confused with the thermal efficiency of the associated energy conversion device, which may have a lower value. Examples for selected fuel cycles are given. Author (NSA)

N71-37303# Princeton Univ., N.J. Plasma Physics Lab.
LEAD SHIELDED DEWAR DEVELOPMENT
G. D. Martin and J. W. Willard May 1971 11 p refs Presented at the 4th Symp. on Eng. Probl. of Fusion Res., Washington, D. C., 20-23 Apr. 1971
(Contract AT(30-1)-1238)
(MATT-846; Conf-710418-11) Avail: NTIS

Results of a recent development program to increase operating time of levitated rings are presented. Fabrication and cryogenic and mechanical testing of 20- and 36-in. major-diameter lead shielded toroidal Dewars are described. Thirty to sixty pounds of lead shielding was applied to a glass epoxy and fiberglass substructure separated by a vacuum gap from the inner chamber. A typical installation consisted of lead-copper sheet laminates applied to a tinned copper base. Cooling of the lead jacket was accomplished by a separate cooling loop or by vent gases from the inner chamber. Mechanical integrity of the lead shield assembly was evaluated by shock testing the assembly in excess of 10 g's at 77 K. Test results indicate that the addition of 32 lbs of lead shielding increases the isochoric operating time of a typical 36-in. ring by a factor of 2.5 or more. Author (NSA)

N71-37304# Princeton Univ., N.J. Plasma Physics Lab.
STELLARATOR-MIRROR MACHINE TARGET PLASMA REACTOR
J. M. Dawson, H. P. Furth, and F. H. Tenney May 1971 11 p refs
(Contract AT(30-1)-1238)
(MATT-841) Avail: NTIS

The stellarator configuration appears particularly well suited as a container of target plasma for energetic ions trapped in a local mirror section. Author (NSA)

N71-37305# Princeton Univ., N.J. Plasma Physics Lab.
SPECIAL DIAGNOSTIC DEVICES
R. S. Christie and D. S. Knutson May 1971 12 p refs Presented at the 4th Symp. on Eng. Probl. of Fusion Res., Washington D. C., 20 Apr. 1971
(Contract AT(30-1)-1238)
(MATT-838; Conf-710418-9) Avail: NTIS

Several of the special diagnostic devices, designed to solve particular positioning and measurement problems, are described and illustrated. In particular, the problems associated with achieving the various mechanical movements within a vacuum, and the methods employed in controlling the coaxial conductors from the probe tip to the vacuum feedthrough are discussed. Author (NSA)

N71-37306# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.
NONLINEAR ECHO PHENOMENA IN PLASMA

A. G. Sitenko 1970 17 p refs
(ITF-70-56) Avail: AEC Depository Libraries

Echo effects are considered in plasma conditioned by an undamped character of the distribution function oscillations that appear under the influence of perturbations shifted in time. The cases of two and three external perturbations are studied. The high- and low-frequency echo oscillations appearing in plasma under the influence of the external charges are investigated, particularly considering the echo effects associated with the oscillation transformation. It is shown that for echo phenomena associated with oscillations, the dispersion of which is determined by the character of the distribution function, external perturbations are possible. The possibility of third-order echo oscillations is shown if the wave vectors of perturbations lie in one plane; even in the case of longitudinal perturbations, the echo oscillation field contains both longitudinal and transverse components. Author (NSA)

N71-37307# Akademiya Jauk URSR. Kharkov. Fiziko-tekhnicheskii Inst.
MEASUREMENT OF THE DENSITY OF A PLASMA WITH THE AID OF AN OPEN RESONATOR [IZMERENIE PLOTNOSTI PLAZMY PRI POMOSHCHIOTKRYTOGO REZONATORA]
I. Ulahmid 1970 18 p refs In RUSSIAN
(KHFTI-69-51) Avail: AEC Depository Libraries

The application of the FABRY-Perot resonator is considered for measuring plasma density. It combines the advantages of classical interferometers with resonator-sensitivity methods and allows density measurements in a wide range with good spatial resolution. For the measurement of plasma density in devices with metal chambers, it is possible to use directly a certain part of the chamber, forming an opened cylindrical resonator. A great disadvantage of such a resonator is the averaging of density values along the whole system. The methodology of determining plasma parameters (electron density and the electron-ion collision frequencies) does not differ from that used in the case of closed resonators. However, the open resonator has a discharge spectra that allows measurements to be conducted simultaneously on several highly differing frequencies. The use of types of oscillations with different radial field distributions gives the possibility of determining the radial distribution of plasma density. Author (NSA)

N71-37308# United Kingdom Atomic Energy Authority, Culham (England).
REPORT ON EXPERIMENTS ON THE SUPPRESSION OF FLUTE INSTABILITY BY MEANS OF A FEEDBACK SYSTEM IN PHOENIX 2
V. A. Chuyenov [1970] 57 p refs Transl. into ENGLISH from Russian report IAE-2012
(CTO-737) Avail: AEC Depository Libraries

Experiments are described relating to the stabilization of flute instability in the Phoenix 2 plasma at densities approximately 10 to the ninth power per cubic centimeter, using a one-electrode feedback system. A detailed comparison is made between the experimental results and computer calculations based on a theory that takes account of the frequency response of the feedback system. Author (NSA)

N71-37309# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LIMIT CHARACTERISTICS OF AN MHD GENERATOR WITH A NONEQUILIBRIUM PLASMA
A. V. Gubarev et al 29 Jan. 1971 12 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Energ. Transp. (USSR), no. 1, 1970 p 167-170
(AD-726588; FTD-HT-23-888-70) Avail: NTIS CSCL 10/2

By using known relationships of the energy balance for electrons and dependence of the conductivity of a turbulent plasma on the Hall parameter, the authors obtained useful relationships which permit evaluating the maximum parameters of an MHD generator operating on a nonequilibrium plasma. It is shown that with argon having an addition of cesium vapors at an electric load coefficient of 0.8 the maximum pressure in the reactor must not exceed 100 atmospheres absolute, even at the presently practically limiting values of reactor outlet gas temperature approximately 2500 degrees K, magnetic field induction approximately 10 T, and power of a given single MHD generator channel. It is shown that with a reduction in M number from 2.0 to 0.5 the maximum permissible pressure in the reactor is reduced from 70 to approximately 20 atm abs. With an increase in initial temperature and the other parameters remaining constant, the maximum value of capacity of a single unit is reduced. The article contains four illustrations.
Author (GRA)

N71-37310# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
LANGMUIR PROBE DIAGNOSTICS IN THE ELMAX PLASMA DEVICE
James R. Nunn (M.S. Thesis) Mar. 1971 87 p refs
(AD-726990; GEP/PH/71-14) Avail: NTIS CSCL 20/9

Cylindrical Langmuir probes were used to determine quiescent plasma conditions and instability thresholds in a mirror geometry magnetoplasma experiment (ELMAX). Radial profiles of electron temperature, density, and velocity distribution were measured in an argon plasma maintained by two magnetic annular arc sources. A digital data recording system was devised which facilitated reduction of the probe curves with a computer program using collisionless probe theory. For magnetic fields below 400 gauss the peak values of electron temperature and density were 40,000 degrees K and 10 to the 13th power/cc respectively, and observed density oscillations were less than 5%.
Author (GRA)

N71-37311# Avco Corp., Wilmington, Mass. Systems Div.
SYSTEMS STUDY OF NON-LINEAR MICROWAVE BREAKDOWN
Ronald L. Fante and Joseph T. Mayhan (Akron Univ., Ohio) 15 Jun. 1971 25 p refs
(Contract F19628-69-C-0121)
(AD-726638; AFCRL-71-0334; Scientific-6) Avail: NTIS CSCL 20/14

The report presents a systems study of the transmission of a high-power pulse through air, including the non-linear interaction of the pulse with the gas. Results are presented for the time evolution of the transmitted power, electron density distribution and electronic field distribution when a plane wave is incident upon a gaseous layer. Author (GRA)

N71-37312# Colorado Univ., Boulder. Dept. of Aerospace Engineering Sciences.
PLASMA TURBULENCE FOR REENTRY SIMULATION Interim Report, 1 Apr. 1970 - 31 Mar. 1971
Charles K. McLane 17 May 1971 11 p
(Grant AF-AFOSR-1908-70)
(AD-726751; AFOSR-71-1945-TR) Avail: NTIS CSCL 20/9

The purpose of the research being pursued under this grant is to produce and characterize a turbulent plasma and to study transport processes in it. Particular attention will be given to diffusion of the plasma across a magnetic field because of the importance of magnetic confinement of plasmas in the upper atmosphere and in fusion research. Turbulent electrical resistivity is also important for heating the confined plasma. Because it is not possible to produce a homogeneously turbulent plasma in the laboratory, the author considers it important to develop a means of measuring the diffusion coefficient locally. The assessment of the problem of doing this, together with the design, specification and construction of the necessary laboratory facilities have occupied this reporting period. Author (GRA)

N71-37313# Office of Naval Research, London (England).
THE INSTITUTE FOR PLASMA RESEARCH AT THE UNIVERSITY OF STUTTGART

Alfredo Banos, Jr. 11 Jun. 1971 11 p refs
(AD-726675; ONRL-R-18-71) Avail: NTIS CSCL 20/9

The report gives an account of a liaison visit to the Institute for Plasma Research of the University of Stuttgart, which is under the direction of Prof. Dr. R. Wienecke, and which as recently as 1969 moved into a new building located in the modern campus outside the city. The main lines of research at present comprise: plasma focus; laser applications; plasma heating and waves; techniques for measuring extremely short intervals of time; numerical studies of the propagation of waves in inhomogeneous magnetoplasmas. The Stuttgart Institute has a staff of some 30 researchers with a PhD or equivalent and, as such, ranks third in West Germany (the other two being Garching and Julich) and first as a Laboratory attached to a university. Author (GRA)

N71-37314# Innsbruck Univ. (Austria). Inst. for Theoretical Physics.
CHARACTERISTICS AND CONSTANTS OF MOTION FOR COLLISIONAL KINETICS EQUATIONS
Ferdinand F. Cap 3 May 1971 10 p refs
(Contract F61052-70-C-0014)
(AD-726620; UNICP-SR77; AFOSR-71-1938TR) Avail: NTIS CSCL 20/9

New collisional kinetic equations of the Bhatnagar-Gross-Krook and Chandrasekhar types are presented and solved using the constants of motion method. Author (GRA)

N71-37315# Wisconsin Univ., Madison. Dept. of Electrical Engineering.
PLASMA INSTABILITIES AND WAVES EXCITED BY AN ANISOTROPIC ENERGY DISTRIBUTION PRODUCED BY ELECTRON CYCLOTRON RESONANCE Quarterly Progress Report, 15 Dec. 1970 - 14 Sep. 1971
J. L. Shohet 15 Mar. 1971 62 p refs
(Contract AT(11-1)-1695)
(COO-1695-33; QPR-16) Avail: NTIS

Bremsstrahlung measurements were made to determine the polarization distribution of the free-free bremsstrahlung exciting radially along the midplane. The scattering method was used with beryllium as the scattering material. Use of this material, together with improved pulse counting techniques has resulted in a 5-fold increase in the scattered X-ray flux, necessitating counting times of only 200 to 400 minutes. The theoretical work concentrated on a direct evaluation of the scattering matrix elements to obtain a definitive measure of the anisotropy of the free-free bremsstrahlung. Three approaches for plasma simulation were studied: the first is consideration of simulation of electron cyclotron resonance in a 2-dimensional region considering interparticle Coulomb fields; the second approach considers heating of a collection of particles without interparticle reactions; and finally, rf confinement of a large number of particles.
Author NSA

N71-37316# Princeton Univ., N.J. Plasma Physics Lab.
NONLINEAR KINK AND TEARING MODE EFFECTS IN TOKAMAKS
P. H. Rutherford, H. P. Furth, and M. N. Rosenbluth 17 Jun. 1971 20 p refs Presented at the 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17 Jun. 1971
(Contract AT(30-1)-1238)
(Conf-710607-87; CN-28/F-16) Avail: NTIS

To obtain limiting amplitudes for kink modes, two simple models close to marginal stability were considered, and neighboring slightly kinked (bifurcated) helical equilibria were calculated. The stability of these equilibria against perturbations with similar helical symmetry is discussed; cases of stable and unstable neighboring equilibria are found. Typically, the outer region of conducting plasma is strongly stabilizing nonlinearly. The second order change in total plasma current at constant external poloidal flux is calculated, both for the helical equilibrium and during the mode growth; the current change is normally negative but in unusual cases it can be positive. The current change is also calculated for the tearing mode where the outer region is resistive plasma; here it is always negative. The second order paramagnetism is calculated using the radial virial theorem. The paramagnetism gives an estimate of the second order (inward) major radius shift, which gives rise to a slightly increased current. Author (NSA)

N71-37317# Los Alamos Scientific Lab., N.Mex.
Z-PINCH EXPERIMENTS WITH SHOCK HEATING
D. A. Baker, L. C. Bukhardt, J. N. DiMarco, P. R. Forman, A. Haberstich et al 17 Jun. 1971 13 p refs Presented at the 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis. 17-23 Jun. 1971
(Contract W-7405-eng-36)
(Conf-710607-14; CN-28/B-2; LA-DC-12206) Avail: NTIS

Two z-pinch experiments are described. In these experiments, a shock produces plasma temperatures higher than have been produced by ohmic heating. Theory predicts that with the higher temperatures the drift instabilities can be avoided, resulting in a reduction of the anomalous field diffusion. MHD calculations predict stable configurations for some diffuse z-pinch profiles with a reversed B sub z field external to the pinch and a conducting wall. The results, including density and magnetic field profiles, are compared with experiment. The toroidal z pinch has the advantage of having azimuthal symmetry, stable equilibria, and the possibility of exceeding the Kruskal-Shafranov limit.
Author (NSA)

N71-37318# Princeton Univ., N.J. Plasma Physics Lab.
RADIAL TRANSPORT IN TOKAMAK DISCHARGES
D. F. Duecha, H. P. Furth, and P. H. Rutherford 17 Jun. 1971 29 p refs Presented at the 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res.
(Contract AT(30-1)-1238)
(Conf-710607-27) Avail: NTIS

A multifluid numerical code is used to follow the evolution of radial profiles in the Tokamak discharge. Particle diffusion, electron and ion thermal diffusion, energy equilibration, and field diffusion are included in the model. The transport coefficients appropriate to the banana, plateau, and hydrodynamic regimes of classical theory for an axisymmetric torus (neoclassical theory) are employed, with recently calculated numerical coefficients exact to lowest order in aspect ratio. Two basic cases are reported: (1) a simplified three-regime neoclassical code, neglecting particle transport; and (2) a banana-regime code that includes particle transport and modification of the particle and electron thermal fluxes by the trapped-particle pinch effect.
Author (NSA)

N71-37319# Texas Univ., Austin.
IMPORTANCE OF THE TRAPPED PARTICLE PINCH EFFECT IN TOKAMAK PLASMAS
A. A. Ware 17 Jun. 1971 22 p refs Presented at 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17 Jun. 1971 Sponsored by AEC
(Conf-710607-29; CN-28/C-6) Avail: NTIS

A recent discovery has shown that, in a Tokamak plasma, the conservation of canonical angular momentum requires that all trapped particles drift towards the magnetic axis. The effect is considered in relation to the contraction and heating of the plasmas in the Tokamaks T-3 and ST, use being made of the transport equations of Rosenbluth et al. The pulse length in these experiments is too short for a steady state to be attained, and four different phases are distinguished in the heating and compression of the plasma. An approximate calculation that balances ion thermal conduction with the compressional heating is shown to agree well with the final temperature profile in ST. The plasma in T-3 undergoes less contraction and compressional heating, the prime reason being that the driving force for the compression, the toroidal electric field, is maintained at sufficient strength for compression for a relatively shorter time.
Author (NSA)

N71-37320# Princeton Univ., N.J. Plasma Physics Lab.
EFFECT OF NONAXISYMMETRIC CONFINING FIELDS ON
W. Stodiek, K. Bol, H. Eubank, S. von Goeler, and D. J. Grove 17 Jun. 1971 20 p refs Presented at 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17 Jun. 1971
(Contract AT(30-1)-1238; Grant NSF GP-579)
(Conf-710607-33; CN-28/C-10) Avail: NTIS

To test the importance of axisymmetry on confinement, the Tokamak facility can provide a local toroidal field inhomogeneity up to + or - 30%, approximately equal to the radial variation of the toroidal field strength across the aperture. Discharge characteristics of the symmetric and asymmetric cases, respectively, were compared with the following results: a decrease in energy confinement time of 30% is observed for the asymmetric case, resulting from larger power input due to increased plasma resistivity, and to a lesser extent from a reduction of the amount of stored energy. The confinement time always remains longer than that obtained from C stellarator data, assuming Bohm scaling. The plasma resistance increase and the depletion of the energetic tail of the ion distribution, observed for the asymmetric case, are discussed on the basis of single particle trapping. Author (NSA)

N71-37321# Cornell Univ., Ithaca, N.Y. Lab. of Plasma Physics.
NEW RESULTS IN TURBULENT HEATING
C. Wharton, P. Korn, D. Prono, S. Robertson, P. Auer et al 17 Jun. 1971 19 p refs Presented at 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17 Jun. 1971
(Contracts AT(30-1)-3782; AT(30-1)-3958)
(Conf-710607-50; CN-28/E-2) Avail: NTIS

Rapid turbulent heating of a hydrogen plasma was studied in a magnetic mirror by the application of a 200 kV pulse, causing a large current to flow along the magnetic field. When the initial plasma conductivity is less than or equal to 10 mho/m, the onset of turbulence (due to drift-excited two stream instability) occurs at a current threshold predictable by theory. When the conductivity is larger than or equal to 50 mho/m, the skin effect retards current penetration, and the onset of turbulence is delayed, leading to inferior heating. As turbulence develops, the resistivity becomes anomalously large, hard X-rays are emitted, and ions are heated in directions both parallel and perpendicular to Bz by ion acoustic waves excited. Te/Ti becomes large enough. Turbulence decays rapidly and the resistivity drops at a certain nkT where the instability is quenched. Author (NSA)

N71-37322# Academy of Sciences (USSR), Moscow.
EXPERIMENTAL INVESTIGATION OF QUASISTATIONARY LONGITUDINAL ION STREAMS IN THE L-1 STELLARATOR
M. S. Berezhetskii, S. E Grebenshchikov, I. A. Kossyi, I. S. Shtrikova, and I. S. Shpigel 17 Jun. 1971 25 p refs In RUSSIAN; ENGLISH summary Presented at the 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17-23 Jun. 1971
IOH-28/H-4; Conf-710607-104) Avail: AEC Depository Libraries

With the help of a specially developed technique, the motion of the ion component in one direction along the axis of the toroidal chamber was recorded. To explain the observed effect, a hypothesis based on the existence of blocked particles in the toroidal trap was used. In the presence of radial electric fields, the longitudinal velocity distribution function of the particles becomes asymmetric, which leads to the appearance of an effective ion stream directed along the axis of the toroidal chamber. The relationships found in the experiment confirm the unique connection between the electric field and longitudinal ion stream values. Comparison of the experimental results with calculations performed on the basis of the suggested hypothesis confirms the validity of the explanation given of the mechanism whereby the ion stream occurs. Author (NSA)

N71-37323# Kyoto Univ. (Japan).
PLASMA CONFINEMENT EXPERIMENT ON THE HELIOTRON D MACHINE
Koji Uo, Astuo Liyoshi, Shoji Yoshioka, Tatsuo Ishida, and Shigeru Konoshima 17 Jun. 1971 19 p refs Presented at 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17-23 Jun. 1971
(Conf-710607-108; CN-28/H-8) Avail: AEC Depository Libraries

The Heliotron D is a toroidal machine having the helical heliotron field as a confining magnetic field. By changing the combination of the three kinds of field produced by the helical toroidal, and vertical field coils, various kinds of helical heliotron field were obtained. The maximum rotational transform angle of the field is more than 9 pi and the shear parameter is over 2.0. It is possible to form a shallow magnetic well or an antiwell by changing alpha = B(toroidal)/B(helical). The effect of the vertical field on confinement is examined and the optimum beta = B(vertical)/B(helical) is determined. The equidensity contour nearly coincides with the calculated magnetic surface, and the density profile has a sharp boundary. Under optimum conditions the confinement time is about 40 times Bohm time. For gun plasma, observed confinement time is a few tenths of the value predicted by neoclassical theory in an asymmetric toroidal system. Author

N71-37324# Nagoya Univ. (Japan). Inst. of Plasma Physics.
DEPENDENCE OF PLASMA CONFINEMENT ON THE PROPERTIES OF MAGNETIC CONFIGURATION AND PLASMAS IN JIPP STELLARATOR
Kenro Miyamoto, Akihiro Mohri, Nobuyuki Inoue, Masami Fujiwara, Kiyoshi Yatsu et al 17 Jun. 1971 15 p refs Presented at 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17-23 Jun. 1971
(Conf-710607-107; CN-28/H-7) Avail: AEC Depository Libraries

Plasma sources used are a J x B type gun with a fast acting valve, ECRH, and ohmic heating by an air core coil. The plasma parameters cover at a range of the intermediate collisional and collisional regions. It was observed that the diffusion coefficients estimated from the decay times and the plasma radius a are proportional to the 1st to 2nd power of the rotational transform angle. The profile of the density distribution is similar to cos 1.57(r/a) sq which is a solution of the diffusion equation with diffusion coefficients. The confinement times do not depend appreciably on the properties of the magnetic well (and antiwell), and the dependence of confinement on the magnitude of the magnetic field is linear in the experimental conditions. The two-dimensional distributions of the densities and the potentials of plasmas produced by the J x B type gun and ECRH show the existence of convective motion due to the electric fields. The plasma near the center regions is transported across the field to the boundary where the density gradient exists and the fluctuations due to drift waves are observed. Author (NSA)

N71-37325# United Kingdom Atomic Energy Authority, Culham (England).
PLASMA CONTAINMENT IN THE PROTO-CLEO STELLARATOR
R. A. E. Bolton, J. Hugill, D. J. Lees, W. Miller, and P. Reynolds 17 Jun. 1971 14 p refs Presented at 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17-23 Jun. 1971
(Conf-710607-106; CN-28/H-6) Avail: AEC Depository Libraries

Measurements are reported of the confinement of plasma in the Proto-Cleo 1 = 3 stellarator. The plasma was produced in this machine by a variety of methods, including the irradiation of a metallic target by a laser beam, and covers a density range from 10 to the 9th to 10 to the 13 power/cu cm and electron temperatures from 2 to 10 eV. With the rotational transform of up to 2 pi radians used in the experiment, the plasma conditions embrace both the collisionless and the collisional regimes. A

comparison of the observed confinement times and those derived from recent theories is given. The enhanced diffusion predicted for the intermediate and collisionless regimes has been shown by various authors to be explicable theoretically in terms of a unidirectional current flowing along the minor axis of the torus. The experimental evidence for the existence of this current is summarized. Author

N71-37326# Academy of Sciences (USSR), Moscow.
CONFINEMENT OF A PLASMA IN A TWO TURN STELLARATOR AT RESONANCE VALUES OF THE ROTATIONAL TRANSFORM ANGLE
M. A. Ivanovskii, S. N. Popov, A. P. Popryadukhin, and M. A. Rabinovich 17 Jun. 1971 29 p refs In RUSSIAN; ENGLISH summary Presented at 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17-23 Jun. 1971
(Conf-710607-105; CN-28/H-5) Avail: AEC Depository Libraries

In the TOR-2 two-turn stellarator, a field of resonance harmonics with a relative magnitude of the order of 10 to the minus 4th power has a highly destructive effect on the magnetic surfaces. However, with the help of a special compensation system it was possible to take these harmonics to the 10 to the minus 6th to 10 to the minus 7th power level and to obtain magnetic surfaces of a satisfactory shape. At the resonance 1/2 and 3/2, the magnetic islands were compensated by fields with the spatial harmonic: (q,p) = (1,2) and (3,2) respectively. However, at the resonances (iota/2 pi) = 1 and 2, it proved necessary to use two types of compensating harmonic: (1,1) and (2,2) for the resonance (iota/2 pi) = 1 and (2,1) and (4,2) for the resonance (iota/2 pi) = 2, their amplitude and phase being selected in the appropriate manner. A detailed study is made of the influence of perturbation compensation on the lifetime, the oscillation type, and other confinement characteristics of a plasma in a stellarator. It is found that the dependence of plasma lifetime on the degree of compensation is complex, indicating the simultaneous influence of several of the factors noted above. Author (NSA)

N71-37327# Academy of Sciences (USSR), Moscow.
EXPERIMENTAL INVESTIGATION OF PLASMA HEATING AT A FREQUENCY CLOSE TO THE LOWER HYBRID RESONANCE
V. M. Glagolev, N. A. Krivov, and Yu. V. Skosyrev 17 Jun. 1971 18 p refs In RUSSIAN; ENGLISH summary Presented at 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17-23 Jun. 1971
(Conf-710607-142; CN-28/L-6) Avail: AEC Depository Libraries

The collisionless absorption of the HF power of a plasma and the heating of a plasma were studied. A plasma produced by a UHF discharge or a plasma gun and having a density of 2 x 10 to the 12th power/cu cm with a neutral gas pressure of .00015 to .0003 mm Hg is injected into a uniform magnetic field of 3 kOe. Ion-hybrid waves are excited with the help of a coil wound around a quartz tube (diameter 60 mm), which is connected to the injector. The power of the heat generator, which operates at a frequency of 140 Mc, is 200 kW for pulse duration of 100 microsec. The electron velocity distribution along the magnetic field and the transverse and longitudinal ion velocity distribution are studied with the help multigrid probes and an electrostatic ion energy analyzer. The probes, which move along the radius, provide data on the distribution of the hot ions and the electrons over the cross section of the plasma. The transverse plasma energy, determined by measuring the diamagnetism of the plasma, increases with the magnetic field, beginning with a field corresponding to the hybrid resonance of a dense cold plasma. These results agree with the fully developed theory. Author (NSA)

N71-37328# Academy of Sciences (USSR), Moscow. Inst. of Atomic Energy.
PLASMA CONFINEMENT IN A TOKAMAK WITH BETA SUB I >> 1 AND ARBITRARY CURRENT DISTRIBUTION
V. D. Shafranov, E. I. Yurchenko, and A. E. Zakharov 17 Jun. 1971 11 p refs In RUSSIAN; ENGLISH summary Presented at 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17 Jun. 1971
(Conf-710607-84; CN-28/F-13) Avail: AEC Depository Libraries

The problem of the equilibrium of a plasma column is solved by performing an expansion in powers of the parameter epsilon equals the square root of (a/R), it being assumed that beta sub 1 is approximately equal to 1/epsilon. An equation is derived for determining the shape of the cross section of a plasma column with beta sub 1 is much greater than 1 for given boundary conditions. The shape of the transverse cross section of the plasma is related to the magnetic probe readings and to the index characterizing the manner in which the confining transverse magnetic field grows weaker when there is no casing. The criteria for the hydromagnetic stability of plasmas in Tokamak devices are also discussed. Author (NSA)

N71-37329 National Lending Library for Science and Technology, Boston Spa (England).
A FAST HYDROGEN ATOM INJECTOR
V. M. Kulygin et al 1971 34 p refs Transl. into ENGLISH from Russian report
(NLL-CTO/748-(9091.9F); IAE-1952) Avail: Natl. Lending Library, Boston Spa, Engl.: 4 NLL photocopy coupons

An injector is described which produces a flux of hydrogen atoms with energy 15 to 30 keV and intensity above 0.5 A eq. Calculations of the magneto-optical system are given and the particle motion is analysed numerically. An experimental injector was constructed on the basis of the calculations, and the results of measurements are compared with the theory. Also, experiments on the production and shaping of the proton beam and intense fluxes of fast atoms are described. Author

N71-37330 Dartmouth Coll., Hanover, N.H.
A THEORETICAL STUDY OF THE MAGNETOPAUSE CURRENT LAYER
Shin-Yi Su (Ph.D. Thesis) 1970 131 p
Avail: Univ. Microfilms Order No. 70-18108

Two different types of current layer, the tangential and the rotational discontinuity, have been studied from the kinetic theory of warm collisionless plasmas. The two types represent the magnetospheric boundaries of two important magnetospheres models, namely the closed and the open one, respectively. In the tangential discontinuity, the magnetic field component perpendicular to the current layer is negligible and the tangential field generally changes magnitude and direction across the layer. The difference in the magnetic pressure is balanced by particle pressures. Equilibrium solutions for the tangential discontinuity are obtained under the assumption that magnetically trapped energetic or nonenergetic particles are present to nullify any charge separation effects. Finally, a method is presented to calculate a form of the particle distribution function when the magnetic-field profile in the tangential discontinuity is known. Dissert. Abstr.

N71-37331 California Univ., Berkeley.
DIPOLE RADIATION IN COMPRESSIBLE PLASMA
Sing-hsiung Lin (Ph.D. Thesis) 1969 118 p
Avail: Univ. Microfilms Order No. 70-17605

The results of an investigation of a finite cylindrical antenna with (or without) a dielectric sheath in an isotropic compressible plasma are presented. The boundary value problem is formulated in a set of four coupled integral equations through the application of equivalent source principle, and is solved numerically by the method of collocation. The effects of the plasma compressibility, the plasma collision frequency, and the sheath on the antenna current, the input impedance, and the maximum driving voltage (imposed by the linearization assumption) are investigated rigorously. The radiation of electroacoustic waves may raise the input resistance of an electrically extremely short antenna by a factor of 10 to the 8th power. The resonance frequency of the r-f probe is found to be

below the plasma frequency, and the half power width of the resonance is approximately equal to the plasma collision frequency. Dissert. Abstr.

N71-37332 Tennessee Univ., Knoxville.
ION CYCLOTRON INSTABILITIES IN FINITE PLASMAS
Glen Roy Haste, Jr. (Ph.D. Thesis) 1969 126 p
Avail: Univ. Microfilms DS Order No. 70-17821

The microinstabilities of two different plasma models are considered. The Burt-Harris model is an infinitely long annular plasma cylinder and the other is a short mirror confined plasma. The stabilizing effect of finite ion and electron temperatures is determined, and the type of instability is determined. It is shown that the instability whose frequency lies below the ion cyclotron harmonics is an absolute instability, and that the instability whose frequency lies above the harmonics is convective. These calculations are compared with experimental results from DCX-2. The principal frequencies of the instabilities are found to be displaced from the ion cyclotron harmonics by multiples of the bounce frequency, with the frequencies below the harmonics being more unstable than those above. In addition, instabilities are found whose frequencies lie slightly above the ion cyclotron harmonics, which are the modified negative mass instabilities. Finite temperature effects are found to be stabilizing for these instabilities. These calculations are applied to results from DCX-1.5. Dissert. Abstr.

N71-37333 Princeton Univ., N.J.
ANOMALOUS TRANSMISSION AND REFLECTION OF CYCLOTRON WAVES
Jeffrey Brian Marsh (Ph.D. Thesis) 1970 89 p
Avail: Univ. Microfilms Order No. 70-19791

A formalism is developed to describe the propagation along a slowly varying field of purely transverse cyclotron waves. Starting from the coupled set of linearized Vlasov-Maxwell equations, expansions are made in terms of the two small parameters. The one-dimensional wave equation is applied to the case where the field configuration is a magnetic mirror with small field variation which includes points of cyclotron resonance where the local gyro frequency is equal to the wave frequency, and the collisionless low-beta plasma which supports the wave in the regions outside these points is made up of both trapped and untrapped particles. An investigation is made of the processes by which the trapped particles can cause anomalous transmission and reflection of the wave by a nonlocal mechanism. The equations for the transmitted and reflected waves contain the interaction between the incident wave and the trapped particles as source terms. Dissert Abstr.

N71-37334 Princeton Univ., N.J.
THERMAL CONDUCTIVITY AND LOW FREQUENCY WAVES IN COLLISIONAL PLASMAS
Shih-tung Tsai (Ph.D. Thesis) 1970 60 p
Avail: Univ. Microfilms Order No. 70-19806

Temperature perturbations and heat flow terms are retained in the two fluid equations which are used to derive a localized dispersion relation for low frequency electrostatic waves in a nonuniform collision dominated slab plasma immersed in a magnetic field. The Nyquist analysis shows two unstable waves: the collisional drift instability and a new overstability of the entropy wave. The case of electron flow velocity comparable to the ion acoustic wave velocity is studied in detail. The dispersion relation indicates that the wave frequency and the growth rate change only very little for devices with end-plates. The normal mode consists of two oppositely directed running drift waves, and two small-amplitude oppositely directed running entropy waves. The drift waves grow spatially in the direction of electron flow and the backward directed wave has a larger amplitude. Both drift waves have an axial variation which depends on the electron current. Dissert. Abstr.

N71-37335 California Univ., Berkeley.
INSTABILITIES IN A HOT ELECTRON PLASMA
Marvin Jack Schwartz (Ph.D. Thesis) 1969 136 p
Avail: Univ. Microfilms Order No. 70-17650

The anisotropy in velocity space of the plasma was determined by comparing the measured axial plasma distribution with theoretical profiles. A bi-Maxwellian distribution can be made to fit the experimental distribution by appropriate choice of the anisotropy parameter. The observed values of plasma density (cold plus hot), temperature and anisotropy are used to find the unstable modes of the complete electromagnetic dispersion relation for all angles of propagation. The fastest growing mode early in the compression cycle is an electrostatic mode occurring below the second harmonic. The second instability occurs near peak compression, and is often triggered by the crow-barring of the magnetic field at its peak value. The instability results in radial movement of most of the hot plasma across the magnetic field lines. The occurrence of the instability is dependent upon the base pressure and proximity of the metal source to the plasma. The experimental observations are in agreement with the theory of the interchange mode stabilized by the presence of a cold component. Dissert. Abstr.

N71-37467# Academy of Sciences (USSR), Moscow.
PLASMA CONTAINMENT IN ADIABATIC TRAPS
B. B. Kadomtsev *In* its Proc. of the 6th Ann. All-Union Winter School of Space Phys. Part 1 1969 p 268 In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

N71-37469# Academy of Sciences (USSR), Moscow.
A SELF-MODEL OF FLOW IN A RAREFIELD PLASMA
M. A. Gintsburg *In* its Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 270-271 In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

N71-37470# Academy of Sciences (USSR), Moscow.
PARTICLE ACCELERATION IN A COSMIC PLASMA
M. A. Gintsburg *In* its Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 272 ref In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 18 Masers. For related information see also: 10 Electronics.

N71-37336*# Tyco Labs., Inc., Waltham, Mass.
DEVELOPMENT OF SINGLE CRYSTAL BETA-ALUMINA-MEMBRANE
J. T. A. Pollock, R. Stormont, and F. Weld Jun. 1971 40 p refs
(Contract NAS3-14410)
(NASA-CR-72982) Avail: NTIS CSCL 20B

The feasibility of using a crystal growth technique for the growth of beta-alumina sheaths is investigated. Melt containment components fabricated from Mo, W, and Ir are used and it is concluded that only Ir offers sufficient thermodynamic compatibility with the melt. Rods and tubes are grown and characterized using metallographic and X-ray diffraction techniques. They are found to be two phased, composed of beta-alumina and an admixture of alpha-alumina. The appearance of the latter phase is due to sodium loss from the melt and it is suggested that 100% beta-alumina tubes may be grown using apparatus allowing growth in inert gas pressures of up to 30 atm. Author

N71-37337# Commissariat a l'Energie Atomique, Saclay (France). Centre d'etudes Nucleaires
STATE OF THE ART OF PRODUCING STRONG MAGNETIC FIELDS [ETAT DE L'ART DANS LA CREATION DE CHAMPS MAGNETIQUES ELEVES]
G. Bronca 1970 9 p In FRENCH Presented at the Panel on Superconductors, Paris, 17 Mar. 1970
(CEA-CONF-1734; CONF-700341-1) Avail: AEC Depository Libraries

The progress made during the last few years and the studies to be undertaken in the future concerning the use of Type-II superconducting materials in producing strong magnetic fields in large volumes are reviewed. The simple solution due to Stekly on the degradation of superconducting material is recalled. Results obtained from studies of loss and flux jumps are given. Some of the difficulties encountered in the development of superconducting coils are enumerated, and some of the superconducting magnets existing in Europe are described. NSA

N71-37338# Fourier Inst., Grenoble (France).
SUPERCONDUCTIVITY
B. Dreyfus 1970 13 p In FRENCH Presented at the Ann. Study on the Stability of the Techniques of Point Mech.
(CONF-700341-2) Avail: AEC Depository Libraries

The different theoretical ideas on superconductivity are reviewed. The macroscopic model is reconsidered, and the penetration depth defined in terms of the London equation. Thermodynamic potentials at constant temperature and constant applied field are introduced, and hypotheses on the intermediate state, surface energy, coherence length, and vortices are considered. NSA

N71-37339# Electricity Council Research Center, Capenhurst (England).
A THIN FILM DEPOSITION RATE MONITOR
P. D. Johnston and M. J. Copsey Nov. 1970 16 p
(ECRC/N328) Avail: NTIS

A device to measure the rate of deposition and the accumulated thickness of thin films on reflecting substrates is described. The device, which operates on the principle of optical interference in thin films, has proved to be useful in work on the discharge deposition of polymer coatings in the range 0.5 to 5 micrometers in thickness. Author

N71-37340# Cornell Univ., Ithaca, N.Y. Materials Science Center.
EXTRANEOUS GRAIN BOUNDARY DISLOCATIONS IN HIGH ANGLE (110) TWIST BOUNDARIES IN GOLD
T. Schober and D. H. Warrington Apr. 1971 23 p refs
(Contract AT(30-1)-3504)
(NYO-3504-58) Avail: NTIS

An analysis of extraneous grain boundary dislocations (GBDs), having strong Burgers vector components normal to the boundary, is presented for high angle (110) twist boundaries in the fcc structure in the vicinity of coincidence site orientations. The formation of such GBDs and their interactions with twist GBD arrays are studied. Experimental evidence for their existence in thin film gold bicrystals is presented. Observed arrays of extraneous GBDs are interpreted as tilt subboundaries arising from small misorientations about axes lying in the (110) boundary plane. Author (NSA)

N71-37341# Technische Hochschule Munchen (West Germany). Fakultaet fuer Allgemeine Wissenschaften.
ON THE DISPLACEMENT OF THE REFLECTION MAXIMUM E SUB ONE OF UNIAXIAL DEFORMED SILICON SINGLE CRYSTALS AT DIFFERENTIAL POLARIZATION DIRECTION [ZUR VERSCHIEBUNG DES REFLEXIONSMAXIMUMS E SUB 1 VON UNIAXIAL DEFORMIERTEN SILIZIUMEINKRISTALLEN BEI UNTERSCHIEDLICHER POLARISATIONSRICHTUNG]
Heinz Leonhardt (Ph.D. Thesis) Jan. 1971 94 p refs In GERMAN
Avail: NTIS

Quantum mechanical calculations confirm the shift of the E sub one peak in the 3.4 eV reflection spectrum of silicon for linearly polarized light at uniaxial deformation to the /0,0,1/-direction inverse to parallel polarization and vertical to the deformation direction. The imaginary unit of the dielectric tensor is considered a quantum mechanical integer over the Brillouin zone and contains also the square value for the impulse matrix element as well as a function for transfer energy. The diagonalized Hamiltonian for all k-points of a matrix inside the Brillouin zone establishes that only the vicinity of the Brillouin zone center contributes to the peak shift; polarization parallel to deformation direction shifts the E sub one peak to higher energies, and vertical polarization shifts it to lower energies.
Transl. by G.G.

N71-37342# Hamburg Univ. (West Germany).
CRYSTAL KINETICS AND ELECTRON SPIN RESONANCE IN IRON-DOPED CORUNDUM SINGLE CRYSTALS [KRISTALLKINETIC UND ELEKTRONENSPINRESONANZ AN EISEN-DOTIERTEN KORUND-EINKRISTALLEN]
Klaus Draeger (Ph.D. Thesis) 1970 106 p refs In GERMAN
Avail: NTIS

The relationships between growth kinetics of diamagnetic single A12o3 crystals and the electron spin resonance of implanted paramagnetic iron atoms is studied. Verneuil growths of iron doped corundum single crystals show pronounced velocity decreases in comparison to crystallization processes of pure crystal powders. This phenomenon is attributed to iron atom interstitials in the crystal lattice and the formation of an iron enriched diffusion layer that has to be penetrated by the pseudomolecules of the aluminum oxide in order to reach the real crystallization zone. This diffusion layer is stabilized through transformation of Fe203 into the vapor phase. A kinetic model is developed that shows that iron doping also produces anisotropic crystallization processes that effect the lattice formation markedly. Magnetic measurements on positive iron 3 ions by electron spin resonance establish two forbidden transformation lines in the normal spectrum. The absence of resonance lines from exchange-coupled iron pairs is attributed to iron ion positioning in the center of the oxygen-ion arrangement with resulting lattice deformations which inhibit further implantations of neighboring iron ions. Transl. by G.G.

N71-37343# Technische Hochschule Munchen (West Germany). Fakultaet fuer Maschinenwesen und Elektrotechnik.
PROBLEMS IN STRESS BEHAVIOR OF POLYCRYSTALLINE ALUMINUM OXIDE AT ROOM TEMPERATURE [PROBLEME DES FESTIGKEITSVERHALTENS VON POLYKRISTALLEN ALUMINUMOXID BEI RAUMTEMPERATUR]
Anton Wimmer (Ph.D. Thesis) 1971 241 p refs In GERMAN
Avail: NTIS

The statistical theory of Weibull is used to analyze fracture strength scattering values of polycrystalline aluminum oxide crystals. It is shown that sample volume, sample shape, grain size, and porosity of the crystal microstructure determine its friction distribution and tensile strength. Experimental bending studies, surface roughness and friction distribution measurements show good agreement with theoretical fracture strength values.
Transl. by G.G.

N71-37344# Royal Aircraft Establishment, Farnborough (England).
SOLID-STATE MODULATORS FOR HORIZON SENSING APPLICATIONS
B. Ellis Paris ESRO Mar. 1971 103 p refs Sponsored by ESRO
(Contract ESTEC-991-70)
(ESRO-CR-35) Avail: NTIS

A survey of possible solid state modulation mechanisms is given, summarizing the results of an extensive literature survey.

Some twenty-one of these are found to be unsuitable for horizon sensing, but a further three are tested in some detail. Of the latter, it is a device based on the Fabry-Perot interferometer which offers the greatest promise, but a modulator using frustrated total reflection is also possible. The third device, which employs stress-induced birefringence, would only yield a degree of modulation of 19.4% (as compared with values of ca. 58% for the other two), mainly owing to the need for polarizers. These figures apply for an optical bandwidth of 14-16 microns, it being assumed that the radiation is to be converged by an f/1 lens and estimated losses in intensity due to absorption being allowed for. For these three devices some detailed consideration is given to possible drive mechanisms and to the effects of temperature changes of the order of + or - 40 C.
Author (ESRO)

N71-37345# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
HIGH TEMPERATURE ANNEALING OF PHOTOLUMINESCENCE BANDS IN IRRADIATED GERANIUM
Raymond J. Burek (M.S. Thesis) Jun. 1971 91 p refs
(AD-726993; GNE/PH/71-2) Avail: NTIS CSCL 20/12

The isochronal annealing behavior, between 20 degrees C and 420 degrees C, of radiation defects in cobalt-60 irradiated germanium was studied by photoluminescence. Spectra were recorded at liquid helium temperature for each 50 degrees C annealing interval, and relative intensity vs. annealing temperature curves were plotted for prominent defect bands. The annealing behavior of a 0.688eV zero-phonon line formed during room temperature irradiation suggests that it may be associated with the germanium A-center. New Mossbauer-type spectra with zero-phonon lines located at 0.686, 0.699, and 0.722eV appeared after annealing at 170 degrees C. Four bands believed to be caused by recombination at dislocations were also observed at 0.511, 0.518, 0.529, and 0.57eV. Author (GRA)

N71-37346# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
NUCLEAR MAGNETIC RESONANCE STUDY OF CADMIUM SELENIDE AND CADMIUM TELLURIDE
Donald L. Moore (M.S. Thesis) Jun. 1971 96 p refs
(AD-726989; GEP/PH/71-3) Avail: NTIS CSCL 20/12

Knight shift and spin-lattice relaxation time has been measured for Cd-113 nuclei in In-doped CdTe. From the Korringa product and the sign of the Knight shift, the electron g-factor has been calculated to be g = -1.2 plus or minus .1, which is a factor of three greater than that previously reported from theoretical estimates. Spin-lattice relaxation is due to contact hyperfine interactions. Degenerate and nondegenerate theory was applied to calculate the atomic volume normalized electronic probability density and the hyperfine constant, A sub H. The CdSe experimental data indicated material constants a factor of three greater than known values; therefore, the results are inconclusive. Author (GRA)

N71-37347# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
MOSSBAUER STUDY OF THE MAGNETOCRYSTALLINE ANISOTROPY OF NdCo5
Carl D. Towery (M.S. Thesis) Jun. 1971 113 p refs
(AD-726991; GEP/PH/71-18) Avail: NTIS CSCL 20/12

The project was initiated to determine if Mossbauer spectrometry can be used to monitor manufacturing processes of permanent magnets made of rare earth-3d transition element compounds. Mossbauer spectra were obtained with absorbers made of powdered NdCo5 alloyed with Fe57. These spectra were obtained at four different temperatures in a range over which a 90 degree rotation of the magnetic axis of NdCo5 is known to occur. The spectra were complex and changed significantly as temperature changed. The number of absorption peaks in each of the spectra indicates that Fe57 may enter three nonequivalent crystal lattice sites in NdCo5. Author (GRA)

N71-37348# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
EXISTENCE OF A QUASILIQUID FILM ON THE SURFACE OF ICE
V. I. Kvlividze et al [1970] 5 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 191, no. 5, 1970 p 1088-1090
(AD-726864; CRREL-TL-288) Avail: NTIS CSCL 08/12

The hypothesis of existence of a quasiliquid film on the surface of ice at temperatures below its melting point (T(melt)) was first stated by M. Faraday for explanation of a number of mechanical properties of ice. In this report the author describes the use of nuclear magnetic resonance to discover the nature of the surface of ice. This method makes it possible to obtain the most complete information about the degree of mobility of the molecules. Author (GRA)

N71-37349# Utah Univ., Salt Lake City. Dept. of Physics.
ELECTRONIC AND RADIATION DAMAGE PROPERTIES OF RUTILE Technical Report, 1 Jun. 1970 - 31 May 1971
John W. De Ford, Owen W. Johnson, and Franz Rosenberger 30 Jun. 1971 11 p refs
(Contract DAHC15-70-G-13; APRA Order 1610)
(AD-726752) Avail: NTIS CSCL 20/2

During the report period on the study of rutile the work has been concentrated in the areas of crystal growth, sample preparation, devices and the Hall effect. Included is a review paper and a report on infrared experiments. GRA

N71-37350# Stanford Univ., Calif. Dept. of Materials Science.
A THEORY OF THE REPLACEMENT PARTITION FUNCTION FOR CRYSTALS IN NUCLEATION THEORY
G. M. Pound, Kazumi Nishioka (Oslo Univ.), and Jens Lothe (Oslo Univ.) 1971 32 p refs Sponsored in part by ARPA
(Grant NSF GK-2159)
(AD-726738; SU-DMS-71-T-60) Avail: NTIS CSCL 20/2

The replacement partition function is formulated for crystals and it is concluded that: (1) The replacement partition function is a well-defined fundamental quantity of the bulk crystal. (2) It is due to the translational and rotational motions of the clusters in the bulk for which all the atoms are fixed at the lattice points defined for each cluster, which is in agreement with the assertion by Lothe and Pound. (3) It is reasonable to ascribe the surface free energy of a cluster in vapor to the ratio of the internal partition functions of the cluster in vapor and in bulk crystal, respectively, which is also in agreement with the assertion by Lothe, Pound and co-workers. Author (GRA)

N71-37351# Minnesota Univ., Minneapolis. School of Chemistry.
ELECTRONIC PROPERTIES OF OXIDE INSULATORS Final Scientific Report, 16 Mar. 1969 - 15 Apr. 1971
John E. Wertz May 1970 9 p refs
(Grant AF-AFOSR-1692-69)
(AD-726647; AFOSR-71-1939-TR) Avail: NTIS CSCL 20/12

Studies of the point defects in the alkaline earth oxides MgO, CaO, and SrO centered upon the trapped-electron or F-type centers, the trapped-hole or V1-type centers and the various valence states of substitutional impurities. Attempts have been made to correlate numerous other electronic properties: optical absorption, luminescence behavior, charge-release phenomena, and the Hall coefficient with electron spin data. Largely, the behavior has been in accord with prediction, but with some surprises; for example, the F center in MgO was observed to give a photo-induced Hall effect appropriate to holes as the majority carrier, whereas for the CaO and SrO one finds electrons, as expected. This is attributed to the very-low lying ground state of the F center in MgO, i.e., the level lies in the vicinity of the valence band. Two substitutional defects recently studied are the Fe(3+) ion and the Ti(3+) ion in MgO, both with an associated cation vacancy in the next-nearest neighbor cation position. These represent almost ideally simple examples of d1 and/or d5 ions in octahedral-plus-tetragonal symmetry. Recent

theoretical studies have been made of the hole trapped adjacent to a positive ion cavancy in order to determine the extent to which the localized model is applicable. Present results are not conclusive. Author (GRA)

N71-37352# Illinois Univ., Urbana. Coordinated Science Lab.
ISOTHERMAL ANNEALING OF THE 0.97 ELECTRON VOLT LUMINESCENCE IN ELECTRON-IRRADIATED SILICON
Edward Hung-Hay Wong Jun. 1971 59 p refs
(Contract DAAB07-67-C-0199)
(AD-726916; R-517; UIU-ENG-712220) Avail: NTIS CSCL 20/2

Low temperature photoluminescence in pulled Si irradiated with 3 MeV electrons exhibits a prominent zero-phonon line at 0.97 eV which anneals between 200 and 275 degrees C according to previous isochronal data. Isothermal annealing measurements are reported which reveal an activation energy of about 1.34 eV for the annealing of this line. Author (GRA)

N71-37353# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
ELECTRONIC AND MAGNETIC RAMAN EFFECT IN GARNETS Final Scientific Report, 1 Sep. 1969 - 28 Feb. 1971
Richard K. Chang Jun. 1971 24 p refs
(Contract F44620-69-C-0102)
(AD-726663; AFOSR-71-1803TR) Avail: NTIS CSCL 20/12

The report summarizes the results of research of the electronic and magnetic Raman effect in garnets. The principal results include the determination of Raman active phonons and electronic levels in DyAlG, DyGaG, YbAlG, YbGaG, and LuAlG. The experimental and theoretical techniques developed during this period can be readily applied to all other rare-earth garnets; in particular, rare earth in iron garnets, which may offer potentials for tunable IR quantum detectors and tunable lasers. Author (GRA)

N71-37354# Minnesota Univ., Minneapolis. Dept. of Electrical Engineering.
MICROWAVE STUDIES OF SEMICONDUCTOR CRYSTALS Final Report, 1 Nov. 1966 - 31 Jan. 1971
Keith S. Champlin May 1971 24 p refs
(Grant AF-AFOSR-0606-67)
(AD-726664; AFOSR-71-1958TR) Avail: NTIS CSCL 20/12

For the past several years, microwave bulk effects have received considerable attention in many laboratories. This work has been principally motivated by prospects of generating and amplifying microwaves directly with bulk semiconductors. This research is of an allied but somewhat different nature. Bulk phenomena in elemental and compound semiconductors have been investigated by techniques in which measurements of magnitude, phase, and polarization of microwave signals reflected from a semiconductor surface were used. For normal electronic conduction, these measurements directly yielded the electron relaxation time and provided determinations of electron density, mobility, and effective mass. Three areas which were investigated are the large anisotropic change in microwave conductivity upon application of a uniaxial stress; the anomalous microwave conductivity associated with electrons bound to impurity states at low temperature; and the microwave conductivity of hot carriers under the influence of an exciting electric field. The information gained in this investigation has increased understanding of both the nature of bulk semiconductors in general, and also the precise physical mechanisms underlying these phenomena. Author (GRA)

N71-37355# California Univ., Livermore. Lawrence Radiation Lab.
SEMICONDUCTOR DETECTORS FOR USE IN THE CURRENT MODE
Robert W. Kuckuck 10 Feb. 1971 67 p refs
(Contract W-7405-eng-48)
(UCRL-51011) Avail: NTIS

Topics include descriptions of typical current-mode detectors, response to radiations-theory and experiment, time response, linearity-dynamic range, field applications, and environmental and damage considerations. NSA

N71-37356# British Petroleum Co., Ltd., Sunbury-on-Thames (England). Research Center.
A GUIDE TO LEED NOMENCLATURE: SOME SIMPLE MESHES AT HEXAGONAL, SQUARE AND RECTANGULAR SURFACES AND THEIR RECIPROCAL NETS
T. Edmonds 15 Jan. 1971 59 p refs
(Rept-10-156) Avail: NTIS

The theoretical LEED patterns (reciprocal nets) arising from some simple hypothetical surface unit meshes on the three closest packed faces /(111), (100), (110)/ of a FCC crystal have been drawn to facilitate identification of structures observed in experimental work. The nomenclature used to describe these structures is presented in detail. Author

N71-37357 National Lending Library for Science and Technology, Boston Spa (England).
BOUNDARY DISLOCATIONS AND THEIR BURGERS VECTORS IN COINCIDENCE-SITE LATTICE GRAIN BOUNDARIES
Yoichi Ishida 13 May 1971 11 p refs Transl. into ENGLISH from Nippon Kinsoku Gakkaishi (Japan), no. 33, 1969 p 1128-1134 In ENGLISH and JAPANESE
(NLL-M-20645-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The dislocations observed in the grain boundary of an annealed iron-manganese alloy are discussed. The orientation relationship between the neighboring grains is described. The Burgers vectors of lattice dislocations form the superlattice of the vectors of the grain boundary dislocations. Thermal stresses within grain boundaries due to electron beam radiation are reported. Author

N71-37358 National Lending Library for Science and Technology, Boston Spa (England).
RECENT STUDIES OF FIELD EMISSION FROM CADMIUM SULPHIDE
H. Neumann 13 Apr. 1971 10 p refs Transl. into ENGLISH from Ann. Physik (Leipzig), v. 25, no. 2, 1970 p 136-142
(NLL-Trans-2751-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The field electron emission from CdS was studied as a function of temperature and exposure. The current voltage characteristics obtained can be explained in terms of a voltage drop at the emitter, and emission from a superficially degenerate conduction band. There was some influence from space-charge limited currents on the field emission characteristics. Exciton lines are observed in the spectral distribution of the emission current at 77k. Author

N71-37359 National Lending Library for Science and Technology, Boston Spa (England).
EFFECT OF NONSTOICHIOMETRY ON THE MOESSBAUER SPECTRA OF MAGNETITE
V. P. Romanov et al 10 Mar. 1971 8 p refs Transl. into ENGLISH from Fiz. Tverd. Tela (Leningrad), v. 12, no. 6, 1970
(NLL-CE-Trans-5586-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The Mossbauer effect was used to measure magnetic spectra with about 4% vacancies and with nonstoichiometric characteristics. Author

N71-37360 National Lending Library for Science and Technology, Boston Spa (England).
A COMPARATIVE INVESTIGATION INTO THE EFFECT OF

VARIOUS CRYSTAL MODELS ON THE SCATTERING OF THERMAL NEUTRONS IN BERYLLIUM OXIDE USING THE COMPUTER PROGRAMME COLLI
Guenter Schroeder [1971] 95 p refs Transl. into ENGLISH of Kernforschungsanlage, Juelich, West Germany, Report KFA-610 (NLL-WH-Trans-306-(9091.9F); KFA-610) Avail: Natl. Lending Library, Boston Spa, Engl.: 10 NLL photocopy coupons

A systematic investigation is presented of the effect of the phonon spectra derived from different crystal models on the scattering properties of beryllium oxide as a moderator. The COLLI program, developed for calculating scattering matrices of polycrystalline moderators was utilized and is described. The quantum mechanics and crystal theory assumptions and approximations made in the theoretical derivation of the scattering law are outlined for a multiparticle system. The dual differential scattering cross section is deduced by Born approximation and the scattering law, which is dependent on neutron energy and pulse changes, is calculated as a Fourier transformation of the intermediate scattering function. J.M.

N71-37381 National Lending Library for Science and Technology, Boston Spa (England).
MONTE-CARLO TREATMENT OF SYSTEMATIC ABSORPTION PHASES
G. Erl et al 13 Apr. 1971 18 p refs Transl. into ENGLISH from Surface Sci. (Amsterdam), v. 21, no. 1, 1970 p 61-75 (NLL-PORS-Trans-2706-(9022.61)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Absorption on crystal planes leads very frequently to the formation of ordered surface structures as demonstrated by low energy electron diffusion (LEED). The equilibrium configuration depends on the interaction energies between the absorbed particles which can be estimated in simple cases from LEED observations. The transition from a random to an ordered configuration by means of surface diffusion can be computer-simulated using the Monte-Carlo method. The corresponding positions of extra spots in the LEED pattern are calculated. The method has been applied to the system Pd(110) + O2. In particular it is shown that the observed continuous splitting of diffraction spots is a consequence of the statistical behavior of the system. Author

N71-37382 Stanford Univ., Calif.
LIQUID EPITAXY AND PHYSICAL PROPERTIES Ga(1-)LC] X)Al(x)As
Marc Ilegems (Ph.D. Thesis) 14 Oct. 1971 97 p
Avail: Univ. Microfilms Order No. 70-18418

The relationships between crystal composition, melt composition, and temperature of growth were studied and the ternary Ga-Al-As phase diagram was derived. The optical properties of the epitaxial layers were investigated in the direct band gap and reststrahlen regions. The mixed crystal layers were grown on (111) oriented GaAs substrates out of Ga-rich melts using a vertical liquid epitaxy setup. The 1000 C solidus isotherm in the ternary phase diagram was obtained by determining the composition of the layers grown at that temperature as a function of the Al concentration in the melt. The results obtained for the GaAs-AlAs system were extended to other III-V mixed crystal compounds and preliminary phase diagram calculations for the Ga-Al-Sb and the Ga-In-As systems are presented. The infrared lattice vibration spectra of Ga-Al-As mixed crystals were studied by measuring the room temperature reflectivity at near normal incidence in the 200-600/cm frequency range. Dissert. Abstr.

N71-37383 George Washington Univ., Washington, D.C.
A CONTINUUM THEORY OF DISLOCATIONS AND DISLOCATIONS LOOPS
Douglas Linwood Jones (Ph.D. Thesis) 1970 82 p
Avail: Univ. Microfilms Order No. 70-19531

A correspondence between the dislocation density tensor and the dislocation loop density tensor is presented pursuant to a better understanding of the mechanisms responsible for the plastic deformation of metallic crystals. This correlation is established by examining and refining the definition of the plastic distortion tensor to include independent contributions from the dislocation density and dislocation loop density tensors. These tensors are considered to be state quantities in the thermodynamic sense. The major results of this dissertation are separated into a static and a dynamic theory. The static theory of dislocations and dislocation loops is comprised of relationships between the dislocation state tensors and various time-independent quantities which are of basic importance to the theory of plasticity. In order to establish the dynamic behavior of dislocations and dislocation loops a functional relationship is developed between the dislocation motion tensor and the dislocation state tensors. Then the contribution of the dislocation density tensors to the dislocation flux tensor and the plastic curvature rate is established by exploiting the relationship between the dislocation flux tensor and the dislocation motion tensor. Dissert. Abstr.

N71-37384 Princeton Univ., N.J.
DECAYING PHOTOCURRENTS IN POLYVINYLCARBAZOLE
James Edward Carnes (Ph.D. Thesis) 1970 128 p
Avail: Univ. Microfilms Order No. 70-19771

Decaying photocurrents in polyvinylcarbazole (PVK) were studied to provide information about charge transport and trapping states in the material. Sandwich structures of PVK (2 micron to 27 micron thick) between metal electrodes were irradiated with weakly-absorbed light (3650A) with no voltage applied. After the light was removed, a voltage was applied and decaying currents in excess of capacitive charging currents were observed. The contacts (Au and Al) were found to be blocking and the electric field was found to be constant in time and uniform in space. It is concluded that the current must be due to holes stored and subsequently released only at the surface which then drift completely across the sample. The excitation and time dependence of the current is explained by a model involving charge storage in a uniform distribution in energy of hole traps. Dissert. Abstr.

N71-37385 Stanford Univ., Calif.
ACOUSTOELECTRIC SURFACE-WAVE AMPLIFICATION
Kenneth Meade Lakin (Ph.D. Thesis) 1970 78 p
Avail: Univ. Microfilms Order No. 70-18431

An equivalent acoustoelectric effect has been independently demonstrated using surface acoustic waves on an insulating piezoelectric delay line coupled to an adjacent nonpiezoelectric semiconductor containing drifting carriers. The coupling between the acoustic waves and charge carriers is facilitated by the slow TM wave that exists within the air gap and results in an equivalent acoustoelectric effect. The experiments demonstrate the first practical acoustoelectric amplifier with net terminal gain, low power dissipation, and stable continuous drift field operation. It further demonstrates the first CW acoustoelectric oscillator with continuous drift field and external feedback, the first demonstration of CW acoustoelectric mixing and demodulation, and, finally, the first experimental evidence of surface wave transduction by signal injection and reception at the drift field terminals. Dissert. Abstr.

N71-37386 California Univ., Berkeley.
PIEZOELECTRIC FIELD-EFFECT TRANSISTOR STRAIN TRANSDUCERS
James Conragan (Ph.D. Thesis) 1969 135 p
Avail: Univ. Microfilms Order No. 70-17534

Drain current-drain voltage equations are derived for the basic insulated-gate field-effect transistor (IGFET) and junction-gate field-effect transistor (JFET). The equations are then used to determine the sensitivity of the drain current to nonpiezoelectric and piezoelectric strain effects. Experimental data are presented for the piezoelectric-semiconductor PI-FET and the piezoelectric-substrate PI-FET structures. Cadmium sulfide thin-film IGFET's were used in the study of the piezoelectric-semiconductor PI-FET and Te thin-film devices were used in conjunction with PZT-5A to form piezoelectric-substrate PI-FET's. The strain sensitivity of

the Te devices is shown to be controllable by the polarization of the PZT substrate. Typical gauge factors for experimental devices are 500 for the CdS Pi-FET's and 5000 for the Te-PZT PI-FET's. In comparison, the piezoresistive effect in Te devices yields a gauge factor of only 50. Dissert Abstr.

N71-37367 Ohio State Univ., Columbus.
SILICON 1 gf-VALUES
Frank Louis Damm (Ph.D. Thesis) 1970 79 p
Avail: Univ. Microfilms Order No. 70-19304

The absolute scale for neutral silicon gf-values was investigated using a pressure driven shock tube as the emission source. The data was collected over the following range of parameters: (1) temperatures from 7700 K to 9100 K; (2) pressures from 4.0 to 4.5 times one million dynes per square centimeter with 7 to 17 times 10 to the 15th power electrons/electrons per cubic centimeter cm; (3) concentrations of the Si(CH3)4 additive in the test gas from 0.17 to 0.27 percent with 60 to 85 per cent of the silicon ionized. The line emission intensities were determined photographically with a rotating drum spectrograph using a D.C. carbon arc for the intensity standard. One of the lines was monitored photoelectrically as a check on the photographic intensity determinations. A quartz transducer recorded the pressure; the temperature was determined by a line reversal method. Dissert. Abstr.

N71-38645# Plessey Co., Ltd., Ilford (England). Microelectronics Div.
THIN FILM ACTIVE FILTERS
B. J. Green *In* Polytech. of N. London Microcircuits and Their Appl. Jun. 1971 8 p refs (See N71-38625 23-10)
Avail: NTIS

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N71-37388# Explosives Research and Development Establishment, Waltham Abbey (England).
COMPOSITE PROPELLANTS: STATISTICAL EVALUATION OF BRITTLE POINT (EMBRITTLEMENT TEMPERATURE) TESTS
R. W. Bryant Nov. 1970 17 p refs
(AD-727038; ERDE-TN-22) Avail: NTIS CSCL 21/9

Embrittlement temperatures of composite propellants, at nominal uniaxial strains of 5, 10 and 25 per cent, have been measured by two bending beam methods, and the results compared statistically with interpolations from WLF master curves of rupture strain in tension against log reduced strain-rate. Effective strains are deduced which place the majority of the embrittlement temperature values within the scatter of the WLF master curves. It is concluded that the relatively simple embrittlement tests yield measurements of the strain at rupture no more variable than those derived from a similar number of uniaxial tensile tests. Author (GRA)

N71-37369# Anheuser-Busch, Inc., St. Louis, Mo.
CHEMICAL AND PHYSICAL STUDY OF FUELS GELLED WITH CARBOHYDRATE RESINS Final Report, 22 Jun. 1970 - 2 Feb. 1971
James Teng and James M. Lucas Sep. 1971 90 p refs
(Contract DOT-FA70NA-497)
(FAA-NA-71-18; FAA-RD-71-43) Avail: NTIS

A carbohydrate derivative was designed as a gelling agent for turbine fuel. The gelling agent is effective in reducing the fire hazard of the fuel. The free flowing gelled fuel could be adapted readily to existing fuel systems. The rheological profile of the gelled fuel was established over a range of conditions by means of a rotating viscometer, equipped with special measuring heads. Among the rheological parameters which were measured, the viscoelasticity of the gelled fuel appears likely to be a major factor in contributing to the crash-safe character of the fuel. Pertinent physical properties and microbiological data were also compiled to demonstrate that the fuel gelled with the carbohydrate based gelling agent is compatible with present aircraft fuel systems. Author

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N71-37370*# TRW Systems Group, Redondo Beach, Calif.
SPACE SHUTTLE HIGH PRESSURE AUXILIARY PROPULSION SUBSYSTEM DEFINITION Final Report, 1 Jul. 1970 - 15 Jan. 1971
R. A. Benson, A. Shaffer, and H. L. Burge 31 Mar. 1971 788 p refs
(Contract NAS9-11013)
(NASA-CR-115162) Avail: NTIS HC $9.00/MF $0.95 CSCL 21H

The space shuttle high pressure auxiliary propulsion subsystem (APS) definition program is summarized. The analytical effort to investigate for both booster and orbiter baseline vehicles candidate oxygen-hydrogen auxiliary propulsion subsystems capable of meeting Space Shuttle APS requirements, independent of other on-board system integration considerations is outlined. Candidate high pressure APS concepts included any wherein the propellant pressures are augmented to levels higher than storage pressures. Propellant supplies included auxiliary tankage as well as main ascent tank residuals. All propellants delivered to the thrusters were specified to be in a gaseous state. The studies indicate that a basic pumped liquid and subsequent temperature conditioned cycle can be specified which is common to the needs of both the booster and orbiter. The basic cycle can be thermodynamically optimized by making maximum use of available reactant and reaction products. System operating points, weights, and component requirement and preliminary designs were determined to meet overall propulsion system fail operational, fail safe criteria. Author

N71-37371*# TRW Systems Group, Redondo Beach, Calif.
SPACE SHUTTLE HIGH PRESSURE AUXILIARY PROPULSION SUBSYSTEM DEFINITION: EXECUTIVE SUMMARY REPORT
31 Mar. 1971 79 p ref
(Contract NAS9-11013)
(NASA-CR-115161) Avail: NTIS CSCL 21H

The summary findings for the selected cycle which is a pumped liquid, dual gas generation cycle. It features separate gas generators for the turbine and heat exchanger functions. Judicious selection of thruster sizing for the orbiter and booster resulted in a common 840 lbf thruster for each vehicle and allowed a common conditioner design between each vehicle with the same peak demand rates. The cycle also provides for high performance controllability logic as well as single purpose control logic for the low increment velocity APS demands. Author

N71-37372*# Northern Research and Engineering Corp., Cambridge, Mass.
THE DESIGN OF AN ADVANCED TURBINE FOR BRAYTON ROTATING UNIT APPLICATION

Andreas M. Kirschner, Colin F. Robertson, and Anthony F. Carter Jul. 1971 162 p refs
(Contract NAS3-13492)
(NASA-CR-72888; NREC-1159-1) Avail: NTIS CSCL 21E

A complete radial inflow turbine stage comprising an inlet scroll, nozzle row, rotor, and exhaust diffuser has been designed as an alternative to an existing stage of a Brayton cycle turbo-alternator-compressor unit. The design standard results from an optimization of efficiency at the design-point pressure ratio, and hence power output. The relatively low tip speed of the rotor and the operating temperature level permitted an aerodynamic standard for the rotor which is not significantly compromised by mechanical constraints. The selected rotor features a tandem blade row configuration with nonradial blading and backsweep of the rotor inlet blade angle. The nozzle row makes use of a contraction of the axial width across the row to reduce nozzle losses. The design-point efficiency of the stage is expected to be at least 2 percentage points, and possibly 4 percentage points, greater than that of the existing conventional stage; the uncertainty in the prediction results principally from the assessment of losses in the novel nozzle row configuration.
Author

N71-37373*# Pratt and Whitney Aircraft, East Hartford, Conn.
DEVELOPMENT OF COMPRESSOR END SEALS STATOR INTERSTAGE SEALS, AND STATOR PIVOT SEALS IN ADVANCED AIR BREATHING PROPULSION SYSTEMS. PART 2: EXPERIMENTAL DATA AND ANALYSIS Final Report, 28 Jun. 1965 - 23 Oct. 1970
R. M. Hawkins and A. H. McKibbin 24 Nov. 1970 185 p refs
(Contract NAS3-7605)
(NASA-CR-72887; PWA-4059-Pt-2) Avail: NTIS CSCL 21E

The design and development of 28-inch diameter rotating seals for air breathing propulsion systems is discussed. The results of testing the compressor seals, an analysis of two improved self-acting compressor seal designs, and the performance tests of stator pivot seals are presented. Numerical analyses and graphs are used to further substantiate the test results.
Author

N71-37374*# Pratt and Whitney Aircraft, East Hartford, Conn.
DEVELOPMENT OF COMPRESSOR END SEALS STATOR INTERSTAGE SEALS, AND STATOR PIVOT SEALS IN ADVANCED AIR BREATHING PROPULSION SYSTEMS. PART 1: SCREENING STUDIES AND ANALYSIS Final Report, 28 Jun. 1965 - 23 Oct. 1970
R. M. Hawkins and A. H. McKibbin 24 Nov. 1970 213 p refs
(Contract NAS3-7605)
(NASA-CR-72819; PWA-4059-Pt-1) Avail: NTIS CSCL 21E

Screening studies and analysis on 28-inch diameter seals (rotating) are presented. Analysis on 28-inch diameter seals revealed that flexible surfaces or high gas film stiffness was necessary to accommodate expected thermal and mechanical deformations. Mathematical models of general usefulness to seal design were developed. Dynamic testing of the four seals selected for evaluation was limited by failure attributed to loss of dimensional tolerances. Based on results two self-acting seals were designed to obtain reduced sensitivity to seal deformation. Stator pivot seals were designed, fabricated and evaluated at temperatures to 1000 F. Lower leakage rates than possible with current seal design were obtained. Actuation torque was greater than anticipated.
Author

N71-37375*# TRW Systems Group, Redondo Beach, Calif. Propulsion Systems Section.
CHARACTERIZATION OF ATTITUDE CONTROL PROPULSION SYSTEMS
P. F. Thompson and T. J. Walsh Jun. 1971 167 p refs
(Contract NAS9-8166)
(NASA-CR-115183; TRW-17618-H179-RO-00) Avail: NTIS CSCL 21H

The results of an effort to develop generalized, transient and steady-state simulation models for the oxygen and hydrogen attitude control propulsion systems (ACPS) for the space shuttle are presented. The document presents: (1) the results of a literature and computer survey of methods and models currently used to simulate the steady-state and dynamic operation of ACPS and/or individual components; (2) a comparison and evaluation of various simulation techniques obtained from the survey; and (3) the techniques selected or developed for use in this program to develop generalized and flexible steady-state and dynamic simulations models to characterize ACPS. The transient and steady-state computer programs resulting from this effort can be used to characterize the operation of a wide variety of ACPS configurations. Oxygen (O2) and hydrogen (H2) data have been incorporated into the programs to allow ease in evaluation of O2 - H2 ACPS shuttle configurations. Propellant data must be incorporated into the programs in order to simulate ACPS using different liquid or gaseous propellants.
Author

N71-37376*# Hughes Research Labs., Malibu, Calif.
DEFLECTABLE BEAM LINEAR STRIP CESIUM CONTACT ION THRUSTER SYSTEM
C. R. Dulgeroff, D. E. Zuccaro, S. Kami, D. E. Schneller, and J. W. Ward Apr. 1971 138 p refs
(Contract NAS3-13724)
(NASA-CR-72889) Avail: NTIS CSCL 21C

A dual beam thruster system suitable for two-axis attitude control was designed, constructed, and tested. The system is comprised of two orthogonal strips, each capable of producing 0.30 mlb thrust and beam deflections of more than + or - 20 degs. The nominal specific impulse is 5000 sec + or - 500 sec. The thrust level from each strip can be varied from 0 to 100%. The system power required for clean ionizers is approximately 200 W. Neutralizer filaments were developed and life tested over 2000 hours producing more than 40 mA of electron emission per watt of input power.
Author

N71-37377*# General Electric Co., Philadelphia, Pa.
THERMIONIC SPACECRAFT DESIGN STUDY, 120 kw NUCLEAR ELECTRIC PROPULSION SYSTEM. VOLUME 1: SUMMARY Final Report
30 Jun. 1971 76 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952381)
(NASA-CR-122928; GESP-648-Vol-1) Avail: NTIS CSCL 21C

Electrically propelled spacecraft designs for a Comet Halley rendezvous mission, using thermionic reactors as the electrical power source were investigated. Four spacecraft designs were prepared. The four spacecraft designs include two external-fuel reactor concepts providing 120 kWe at 40 VDC to the thrust subsystem and two internal-fuel reactor concepts (10 VDC and 40 VDC) providing 120 kWe to the thrust subsystem. The impact of integration with the space shuttle, the use of U-233 fueled reactors, alternate EM pumps and main radiator systems is assessed for each of the four spacecraft designs. The three 40 VDC spacecraft designs are nearly the same size (1.14 m diameter by 20 m to 22 m long) with specific weights from 28 to 30 kg/kWe. The 10 VDC spacecraft design is 27 m long, with a specific weight of about 33 kg/kWe. Integration into the space shuttle adds 2 kg/kWe to the 40 VDC spacecraft designs, and 6 kg/kWe to the 10 VDC spacecraft. The use of U-233 fueled reactors reduces the specific weight by 5 kg/kWe for a spacecraft design except the 10 VDC internal-fuel concept.
Author

N71-37378*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PEAK AXIAL-VELOCITY DECAY WITH MIXER-TYPE EXHAUST NOZZLES
D. Grossbeck, R. Huff, and U. von Glahn Sep. 1971 27 p refs
(NASA-TM-X-67834; E-6606) Avail: NTIS CSCL 21E

Preliminary results of an experimental study on the peak axial-velocity decay obtained with circular and non-circular nozzles and several mixer-type nozzles is summarized. Prime applications of nozzles having a rapid axial velocity decay are for: (1) reduction of jet exhaust-deflected flap interaction noise

associated with STOL aircraft using an externally blown flap lift augmentation system; (2) VTOL downwash suppression resulting from vertically oriented exhaust nozzles; and (3) conventional exhaust noise suppressors with and without ejectors. With a multi-element nozzle, the velocity of the individual small jets decays rapidly by mixing with the surrounding air. At some distance downstream of the nozzle exit plane, the individual jets coalesce sufficiently to form a large diameter coalescing core and a very slow peak-velocity degradation occurs. Once the coalesced core has fully formed, rapid mixing again occurs with an associated rapid velocity degradation. Author

N71-37379# Los Alamos Scientific Lab., N.Mex.
ROTATING CABLE PUSHER FOR PULSED-PROPULSION SPACE VEHICLE
T. P. Cotter Apr. 1971 6 p
(Contract W-7405-eng-36)
(LA-4666) Avail: NTIS

A propulsion concept for space vehicles is proposed in which a simple array of rotating cables acts as a pusher when suddenly deflected along the axis of intended motion by sequentially discharged explosive pulses. The optimum cable distribution is derived, the basic and perturbed cable motions are analyzed, and the propulsion characteristics of the system are deduced. This pulsating pusher concept offers significant advantages over systems in which a rigid pusher plate and a pneumatic shock absorber are used. Author

N71-37380# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
EUROPEAN POTENTIAL IN ROCKET ENGINE TECHNOLOGY
M. Kaufmann Paris EUROSPACE 1970 15 p Presented at the 4th EUROSPACE US-European Conf., Venice, 22-25 Sep. 1970
Avail: NTIS

In order to present some details of European engine technology, some examples are given of technological achievements with liquid propellant rocket engines. ESRO

N71-37381# Pratt and Whitney Aircraft, West Palm Beach, Fla. Research and Development Center.
DESIGN AND EXPERIMENTAL EVALUATION OF A HIGH-TEMPERATURE RADIAL TURBINE, PHASE 2 Final Report, 18 Jul. 1967 - 31 Aug. 1970
Glenn S. Calvert, Stephen C. Beck, and Uelo Okapuu Ft. Eustis, Va. Army Air Mobility Research and Development Lab. May 1971 223 p refs
(Contract DAAJ02-68-C-0003)
(AD-726466; PWA-FR-4058; USAAMESL-TR-71-20) Avail: NTIS CSCL 21/5

The report describes the design, fabrication and test of a radial turbine designed to produce 219.6 Btu/lb stage work at 87.5% efficiency, with a 5:1 stage pressure ratio. Turbine inlet gas conditions at design point were 257.5 psia and 2300 F. The resulting turbine configuration consisted of an air-cooled, 12-bladed rotor designed for 67,000 rpm, and a 20-vaned air-cooled nozzle section of a reflex-type (supersonic) design. Both parts were designed as IN100 (PWA 658) investment castings. As part of the preliminary design effort, a fabrication study was conducted to evaluate feasible methods of casting the turbine nozzle and rotor. Results showed that the nozzle section could be cast as an integral assembly, but fabrication of the rotor as an integral casting was much more difficult. Bicasting was evaluated as an alternate method of fabricating the rotor, and results showed substantial advantages for the bicasting technique. However, neither method could produce designed rotor properties, and testing was conducted with structurally limited rotors. A test rig was designed and fabricated by the contractor. The test rig consisted of a supercharged gas generator, which had the capability of controlling the turbine load by varying the compressor flow rate. Burner testing preceded turbine testing. Author (GRA)

N71-37382# San Antonio Air Materiel Area, Kelly AFB, Tex. Product Engineering Branch.
EFFECT OF NO/LOW-LEAD MOTOR GASOLINE ON ENGINE OPERATION Technical Report, Oct. 1970 - Jun. 1971
Paul M. Anderson and Eddie J. French Jun. 1971 65 p refs
(AD-727032; SFQT-TR-70-35) Avail: NTIS CSCL 21/4

A study was initiated to determine the effect of no/low-lead motor gasoline on engine operation. Both, regular grade (nominally 93 octane) low-lead and special grade (91 octane) of lead-free gasoline were used. Results were tabulated from Davis-Monthan, Kelly, and Vandenberg AFBs. In no instances were detrimental effects due to lead removal noted. The occurrence of engine knock and engine after-run in selected cases was traced to the low 91 octane of the fuel being used. No/low-lead automotive gasoline of regular grade (nominally 93 octane) will suffice for all Air Force spark-ignition ground equipment in lieu of leaded regular grade fuel. Author (GRA)

N71-37383# Air Force Systems Command, Edwards AFB, Calif. Rocket Propulsion Lab.
ATMOSPHERIC DIFFUSION OF BERYLLIUM (PROJECT ADOBE), VOLUME 1 Final Report, 1 Apr. 1964 - 1 Nov. 1967
Gordon L. Tucker, Hugh E. Malone, and Robert W. Smith Jul. 1971 116 p refs
(Proj. Adobe)
(AD-726899; AFRPL-TR-70-65-Vol-1) Avail: NTIS CSCL 13/2

A field study of exhaust cloud diffusion from solid rocket motors was conducted at the Air Force Rocket Propulsion Laboratory. The objective of the program was to correlate the diffusion of rocket motor exhaust clouds with measurable meteorological variables under both stable and unstable atmospheric conditions. Fifty-seven sets of field data were collected from 250 to 350 air samplers per test using solid rocket motors ranging from 100 to 4000 pounds of propellant containing beryllium. The work is presented in three volumes. Volume I describes the diffusion experiment, the chemical analysis program, the bioenvironmental safety program, and discusses the data analysis and the resulting diffusion equations from hot instantaneous sources. Author

N71-37384*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PERFORMANCE CHARACTERISTICS OF A SINGLE-ENGINE FIGHTER MODEL FITTED WITH AN IN-FLIGHT THRUST REVERSER
Donald L. Maiden and Charles E. Mercer Washington Sep. 1971 130 p refs
(NASA-TN-D-6460; L-7824) Avail: NTIS CSCL 21E

The investigation was conducted at the Langley 16-foot transonic tunnel at Mach numbers up to 1.30. The purpose of the investigation was to establish changes in thrust-minus-drag performance as well as longitudinal and directional stability and control characteristics attributable to an in-flight thrust reverser. The performance results and the effects of the thrust reverser on local surface temperatures and pressures are presented in this report. Test conditions simulated landing-approach conditions as well as high-speed maneuvering such as may be required for combat or steep descent from altitude. The results indicate that the developed thrust control unit will produce reverse thrust up to 52 percent of forward thrust at static conditions and that reverse-thrust effectiveness increased with an increase in Mach number over the speed range investigated. Secondary cooling during reverse thrust and local tail temperatures may require further design considerations. Author

N71-37385# Carleton Univ., Ottawa (Ontario). Div. of Aerothermodynamics.
A COMPUTER PROGRAM FOR THE ANALYSIS AND DESIGN OF TURBOMACHINERY
W. R. Davis Sep. 1971 119 p refs Revised
(ME/A-71-5) Avail: NTIS

A streamline curvature method for analyzing the flow conditions and performance of a turbomachine at design and off-design conditions is described. The inviscid rotational axi-symmetric flow field, with enthalpy and entropy gradients permitted, is determined by an iterative solution. A computer program for the above is described in detail and a FORTRAN listing included. Author

N71-37386# Bureau of Mines, Bartlesville, Okla. Energy Research Center.
MODIFYING DIESEL ENGINE OPERATING PARAMETERS TO REDUCE EMISSIONS
W. F. Marshall and R. W. Hurn Washington 1971 23 p refs Prepared in cooperation with the Environmental Protection Agency, Washington, D.C.
(BM-RI-7579) Avail: NTIS

Fuel injection characteristics and intake air conditions were considered as parameters influencing the emissions. Emphasis was placed on the effect of parameter variations on nitrogen oxide (NO sub x) emissions, because diesels generally emit very low levels of carbon monoxide and unburned hydrocarbons. Emissions other than NO sub x were at lowest levels when the engines were adjusted for best performance. NO sub x emissions can be diminished somewhat through variation in fuel injection characteristics, but there generally are penalties in emissions of CO, smoke, and unburned hydrocarbons or in engine performance. Temperature and composition of intake air have a significant effect on NO sub x emissions. Levels of NO sub x are reduced by recirculating the exhaust gas or by adding water to the intake air stream. However, the rate of water added or exhaust gas recirculated must be limited to prevent the degradation of engine performance and increased emissions of CO and smoke. Author

N71-37387# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AIRCRAFT ENGINES (SELECTED ARTICLES)
Yu. A. Bordovitsyn et al 7 May 1971 88 p refs Transl. into ENGLISH from Tr. Inst. Aviats. (USSR), no. 110, 1969 p 11-15, 27-46, 56-66, 74-92
(AD-727175; FTD-MT-24-18-71) Avail: NTIS CSCL 21/2

Content: The effect of the form of an active gas jet on the characteristics of a gas ejector with short mixing chamber; calculation of the maxium degree of compression of an ejector; the rational method of selecting parameters and calculating single-stage gas turbines; a generalization of the results of measurements of the fineness of fuel atomization of mechanical and at air-mechanical injectors of the pressure-jet type; calculation of temperature field in a cooled turbine blade with longitudinal cooling channels; turbulence in the zone of interplay of jetstreams with the flow. GRA

N71-37388 Mitsubishi Heavy-Industries, Ltd., Tokyo (Japan).
A STUDY ON THE SURGING PHENOMENA IN THE AIR CHARGING SYSTEM OF SUPER-CHARGED DIESEL ENGINES
Takashi Yano and Bunichi Nagata Jul. 1971 18 p refs
(TS-72) Copyright. Avail: Issuing Activity

The surging phenomena as frequently observed in the air charging system of the super-charged diesel engines are considerably different from those experienced with the ordinary blower systems. The periodic disturbance caused by intermittent opening of the scavenging ports has an important effect upon the fluid flow in the air charging system. Analyzed through calculation are the surging phenomena occuring in the air charging system to determine the effects of each element on the phenomena, and by experiments using the test apparatus. A good agreement was observed between the calculation and the experimental results, and it was confirmed that the method of calculation could have practical application. Further, the study turned up some other findings about the surging phenomena in the air charging system which were of interest to take note of when compared with the ordinary blower system. Author

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N71-37389*# Arizona Univ., Tucson. Lab. of Tree-Ring Research
AN EVALUATION OF POSSIBLE RELATIONSHIPS BETWEEN SOLAR ACTIVITY AND TREE-RING GROWTH IN WESTERN NORTH AMERICA Final Report
Harold C. Fritts and Valmore C. LaMarche 15 May 1971 41 p refs
(Grant NGR-03-002-101)
(NASA-CR-119946) Avail: NTIS CSCL 03B

Power spectrum and cross power spectrum analyses, the harmonic dial, digital filtering functions, and principal component analyses were used seperately and in combination to determine the possible association between tree growth variability in western North America and the variation in sunspot numbers since 1700. Special attention was paid to any possible tree growth response to oscillatory solar variation, including the well-known 11 year rhythm, the 22 year double cycle, and a proposed 179 year cycle related to planetary motion. In addition to analysis of individual tree ring chronologies, the study included the comparison of solar variation with the changing magnitude of characteristic regional patterns of tree growth anomalies. Based on principal component analysis, these functions reflect large scale patterns of climatic variation. The results show no evidence of significant, consistent relationships between tree growth and solar variation. Author

N71-37390*# Franklin Inst., Swarthmore, Pa. Bartol Research Foundation.
STRUCTURAL AND SPECTRAL STUDIES OF SUNSPOTS Annual report, 1 Sep. 1970 - 1 Sep. 1971
Arne A. Wyller 29 Sep. 1971 34 p refs
(Grant NGR-39-005-066)
(NASA-CR-122934) Avail: NTIS CSCL 03B

The instrumentation and solar observations at the Bartol Observatory are described. The theoretical studies of sunspots are discussed along with the development of a computer program for generating complete profiles of magnetically active lines. F.O.S.

N71-37391*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md. Lab. for Space Physics.
ON THE ORIGIN AND COMPOSITION OF ULTRAHIGH ENERGY COSMIC RAYS
F. W. Stecker Oct. 1971 7 p refs Submitted for publication
(NASA-TM-X-65713; X-641-71-403) Avail: NTIS CSCL 04A

The origin of cosmic rays at ultrahigh energy is discussed. Three models: galactic; extragalactic, low red shift; and extragalactic, high red shift are considered for the origin. Proton, heavy, and neutrino models are considered for the composition. It is concluded that the galactic origin model of heavy composition is indicated. F.O.S.

N71-37392# Academy of Sciences (USSR). Moscow. Inst. for Space Research.
EXPERIMENTS WITH ARTIFICIAL SOLAR WIND
I. M. Podgorny, E. M. Dolbinin, and G. G. Managadze 1970 43 p refs in ENGLISH and RUSSIAN
(D-15) Avail: NTIS

Simulated magnetosphere measurements at the shock wave front, including investigations of microfluctuations and data on nocturnal geomagnetic field configuration, are discussed. All measurements were carried out on a flat dipole composed of

two parallel conductors with electric currents in opposite directions. ESRO

N71-37393# Aerospace Corp., El Segundo, Calif. Space Physics Lab.
ELECTRON PITCH-ANGLE SCATTERING IN THE OUTER ZONE DURING MAGNETICALLY DISTURBED TIMES
Technical Report, Nov. 1970 - Apr. 1971
Alfred L. Vampola 15 Jul. 1971 18 p refs
(Contract F04701-71-C-0172)
(AD-727003; TR-0172(2260-20)-4; SAMSO-TR-71-155) Avail: NTIS CSCL 04/1

Thorne and Kennel have recently proposed that the rapid loss of energetic electrons in the outer zone observed during magnetic storms is due to pitch-angle scattering arising from a resonant interaction with Doppler-shifted ion cyclotron waves generated by ring current protons. Examination of energetic electron flux pitch-angle distributions obtained by instrumentation on OV3-3 (1966-70A) reveals a number of events which meet most of the requirements of the Thorne-Kennel precipitation mechanism. Primary among these are: narrow (delta L approximately equal to 0.5) spatial distribution of precipitation at and just inside the plasmapause; more rapid scattering of energetic electrons (E = 1.5 MeV) than low energy electrons (E approximately equal to 300 keV); occurrence of the precipitation predominantly at local evening. Author (GRA)

N71-37394# Lockheed Missiles and Space Co., Palo Alto, Calif.
DETECTION OF THE POLARIZATION OF X-RADIATION ON OF SOLAR FLARES
I. P. Tindo et al [1971] 7 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 9, no. 1, 1971 p 118-122
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Three X-ray flares at a wavelength of approximately 0.8 A were recorded by the polarimeter of the Intercosmos-1 which was constructed on the basis of utilizing Thomson scattering. The polarization of approximately 0.4 + or - 0.2 with a 90% confidence was detected in the initial stage of the flares and for the second intensity maximum. Author

N71-37395*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A REVISION OF: COSMIC MATTER-ANTIMATTER ANNIHILATION AND THE GAMMA-RAY BACKGROUND SPECTRUM
F. W. Stecker, D. L. Morgan, Jr., and J. Bredekamp Sep. 1971 58 p refs
(NASA-TM-X-65709; X-641-71-395) Avail: NTIS CSCL 03B

Some initial results are presented of a detailed calculation of the cosmological gamma-ray spectrum from matter-antimatter annihilation in the universe. The similarity of the calculated spectrum with the observations of the gamma-ray background spectrum above 1 MeV suggests that such observations may be evidence of the existence of antimatter on a large scale in the universe. Quantitative comparison of the calculations with the existing observations indicates that the product of interacting matter and antimatter densities at present is approximately equal to or less than 10 to the minus 25th power/cm to the 6th power. Author

N71-37396 National Lending Library for Science and Technology, Boston Spa (England).
EFFECT OF SOLAR RADIATION ON THE TEMPERATURE OF THE ATMOSPHERE
L. R. Rakipova 2 Mar. 1971 9 p refs Trans. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 236, 1969 p 19-24
(NLL-M-20356-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Estimates of the effect of solar radiation on atmospheric temperature are made by using a heat flux equation that allows for variation with latitude at the top of the atmosphere, for variation with latitude of the zenith angles of the sun, and the global asbedo due to reflection from the clouds, the atmosphere, and the underlying surface. Other factors considered are selective absorption of solar radiation, selective absorption and diffuse propagation of long wave radiation, and variations of transmissivity with latitude connected with the distribution of water vapor. G.G.

N71-37397 National Lending Library for Science and Technology, Boston Spa (England).
SOLAR RADIATION ABSORBED BY THE EARTH'S ATMOSPHERE
V. V. Muhenberg [1971] 6 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 249, 1969 p 41-46
(NLL-M-20721-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The spatial distribution of the absorbed atmospheric radiation over the whole earth was calculated as the difference between the radiation absorbed by the earth's atmosphere and the radiation absorbed by the earth's surface. World charts were drawn of the short-wave balance of the atmosphere for December and June, which are characteristic for the winter and summer season of the corresponding hemisphere. The seasonal effects on the atmospheric absorption in middle and high lattitudes are discussed along with that of the tropics. It is concluded that the proportion of solar radiation reflected into space for latitudes from 70N to 60S average 34 to 38% of the solar radiation entering at the upper boundary of the atmosphere. F.O.S.

N71-37398 National Lending Library for Science and Technology, Boston Spa (England).
SOME RESULTS FROM AN INVESTIGATION OF THE FINE STRUCTURE OF FACULAR FIELDS ON THE SUN [NEKOTORYE REZULTATY ISSLEDOVANIYA TONKOI STRUKTURY FAKELNYKH POLEI NA SOLNTSE]
M. N. Stoyanova May 1971 17 p refs Transl. into ENGLISH from Soln. Dannye (USSR), no. 1,1, 1968 p 72-85
(NLL-RTS-6412) Avail: Natl. Lending Library, Boston Spa, Engl.: £1.60; 5 NLL photocopy coupons

The fine structure of small areas of faculer fields is investigated at different levels of the solar atmosphere by the method of escalation. It is shown that inside the small area of a faculer field the inclination of some faculer elements relative to the normal to the solar surface is different. Author

N71-37399 National Lending Library for Science and Technology, Boston Spa (England).
AN INVESTIGATION OF THE FINE STRUCTURE OF A FACULA [ISSLEDOVANIE TONKOI STRUKTURY FAKELA]
M. N. Stoyanova May 1971 12 p refs Transl. into ENGLISH from Soln. Dannye (USSR), no. 1, 1969 p 83-91
(NLL-RTS-6401) Avail: Natl. Lending Library, Boston Spa, Engl.: £1.10; 4 NLL photocopy coupons

A quantitative reduction was made of the H sub alpha, H sub beta and the H and K (CaII) line profiles inside an 18' x 50' faculer area. A change in physical values exists in this area, though the change is rather small and not a regular one. In some cases there is a directional motion in the upper layers of the atmosphere resulting in a distortion of the Doppler core of the profile. Author

N71-37400 New York Univ., N.Y.
SOLAR CYCLE MODULATION OF FAST NEUTRONS IN THE ATMOSPHERE
Milton Merker (Ph.D. Thesis) 1970 139 p
Avail: Univ. Microfilms Order No. 70-19020

The effect of the solar cycle modulation on the production of neutrons in the atmosphere was studied. During the period of increasing solar activity from 1965 to 1969, a series of measurements of the fast-neutron flux in the atmosphere was made. The long term variation of the neutron flux from 2 to 10

Mev was seen to be similar to the modulation of the integral flux of galactic cosmic-ray protons of rigidity greater than 1.3 Gv. The shape of the neutron energy spectrum did not change during this period. For a different energy spectrum power law fit, the average spectral index was 1.17 + or - 0.1 at the transition maximum and 1.08 + or - 0.1 near the top of the atmosphere. From 1965 to 1968 when the Deep River neutron monitor counting rate decreased about 10 percent, the high latitude transition maximum fast-neutron flux decreased 37 percent. A Monte Carlo calculation of neutron production and transport in the atmosphere was made to compare with the results of the experiment and to determine the low energy neutron distribution, the neutron leakage flux, and the radiocarbon production rate.

Dissert. Abstr.

N71-37442# Academy of Sciences (USSR), Moscow.
DETERMINING THE NUMBER OF ANTIPROTONS IN PRIMARY COSMIC RADIATION
E. A. Bogomolov, V. K. Karakadko, N. D. Lubyanaya, V. A. Romanov, M. G. Totubalina et al *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 85-89 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

N71-37444# Academy of Sciences (USSR), Moscow.
PROPERTIES OF NUCLEI DISCHARGED FROM BETA STABILITY POLES
Ye. E. Berlovich *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 94 In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

N71-37445# Academy of Sciences (USSR), Moscow.
COSMIC GAMMA AND X-RAY RADIATION
S. I. Syrovatskiy *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 97-110 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

N71-37446# Academy of Sciences (USSR), Moscow.
LOW ENERGY GAMMA RAYS (0.1-10 MeV) IN THE ATMOSPHERE AND IN SPACE
A. M. Romanov *In its* Proc. of the 6th Ann. All-Union Winter School of Space Phys., Part 1 1969 p 111-123 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

N71-37447# Academy of Sciences (USSR), Moscow.
STUDY OF COSMIC X-RAYS AND GAMMA RADIATION BY ARTIFICIAL EARTH SATELLITES
M. N. Anisimov, L. S. Bratolubova-Tsulukidze, N. L. Grigorov, L. F. Kalinkin, A. S. Melioranskiy et al *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 2 1969 p 124-131 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

N71-37448# Academy of Sciences (USSR), Moscow.
VARIATIONS IN THE ELECTRON COMPONENT OF COSMIC RAYS AT ENERGIES FROM 100 TO 1500 MeV AT HIGH ATMOSPHERIC ALTITUDES
A. M. Galper and B. I. Luchkov *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 132-136 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

N71-37449# Academy of Sciences (USSR), Moscow.
SOLAR NEUTRINO EMISSION
G. Ye. Kocharov *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 137-152 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

N71-37450# Academy of Sciences (USSR), Moscow.
DIFFERENTIAL ROTATION AND THE NONSPHERICITY OF THE SUN'S SURFACE
S. S. Maridrykin and Yu. N. Starbunov *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 153-159 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

N71-37451# Academy of Sciences (USSR), Moscow.
NEUTRINO EXPERIMENTS IN ACCELERATORS
V. S. Kaftanov *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 160-169 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

N71-37452# Academy of Sciences (USSR), Moscow.
STRUCTURE OF INTERPLANETARY SPACE BASED ON OBSERVATIONS OF LOW ENERGY COSMIC RAYS, 1965 TO 1967
S. N. Vernov, G. P. Luubimov, and N. V. Pereslegina *In its* Papers from the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 173-180 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

N71-37453# Academy of Sciences (USSR), Moscow.
DISTRIBUTION OF SOLAR PROTONS WITH AN ENERGY NEAR 1 MeV IN INTERPLANETARY SPACE
S. N. Vernov, Ye. V. Gorchakov, and G. A. Timofeyev *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 181-184 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

N71-37454# Academy of Sciences (USSR), Moscow.
STUDY OF PROTON STREAMS IN THE 1.5 - 50 M EV RANGE BY THE ZOND 4 AND ZOND 5 AUTOMATIC INTERPLANETARY STATIONS
M. M. Bredov, A. A. Kolchin, V. V. Lebedev, and G. P. Skrebtsov *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 185-187 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

N71-37455# Academy of Sciences (USSR), Moscow.
DYNAMIC ORIENTATION OF ATOMIC AND MOLECULAR SPINS AND A NEW METHOD OF DETECTING AN INTERPLANETARY MAGNETIC FIELD
D. A. Varshalovich *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 188-194 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

N71-37456# Academy of Sciences (USSR), Moscow.
THE PROBLEM OF RADIATIVE TRANSFER IN SPACE PHYSICS
Yu. N. Gnedin and A. Z. Dolginov *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 195-204 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

N71-37460# Academy of Sciences (USSR), Moscow.
A MECHANISM FOR THE ACCELERATION OF SOLAR WIND PLASMA
M. V. Konyukov *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 216-217 refs In

RUSSIAN (See N71-37428 23-30)
Avail: NTIS

N71-37482# Academy of Sciences (USSR), Moscow.
SOLAR RADIO WAVE OBSERVATIONS
I. M. Gordon *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 224-228 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

N71-37484# Academy of Sciences (USSR), Moscow.
MAGNETOSPHERIC ELECTRIC FIELDS AND THE ROTATION OF THE EARTH
S. Ye. Bryunelli *In* its Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 242-251 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

N71-37485# Academy of Sciences (USSR), Moscow.
DEVELOPMENT OF MAGNETIC STORMS IN THE EARTH'S ATMOSPHERE
M. I. Pudovskin, S. I. Isayev, and Zaytseva *In* its Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 252-260 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

N71-37472# Academy of Sciences (USSR), Moscow.
INFLUENCE OF NONUNIFORMITY IN SOLAR WIND VELOCITY ON THE STRUCTURE OF THE INTERPLANETARY FIELD
I. I. Alekseyev, A. P. Kropotkin, and A. R. Shister *In* its Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 274 In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

N71-37473# Academy of Sciences (USSR), Moscow.
INTERACTION OF ENERGETIC PARTICLES WITH THE NEUTRAL LAYER OF THE MAGNETOSPHERE TAIL
I. I. Alekseyev and A. P. Kropotkin *In* its Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 275 In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

N71-37474# Academy of Sciences (USSR), Moscow.
LOCALIZATION OF ACTIVITY REGIONS IN THE SUN WHICH ARE RESPONSIBLE FOR THE GENERATION OF A GEOEFFECTIVE AGENT
V. P. Nefedyev *In* its Proc. of the 6th Ann. All-Union Winter School of Space Phys., Part 1 1969 p 276 In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

N71-36994# Environmental Science Services Administration, Honolulu, Hawaii.
DIFFERENTIAL ROTATION OF THE SOLAR ELECTRON CORONA
Richard T. Hansen (High Altitude Obs., Kamuela, Hawaii), Shirley F. Hansen (High Altitude Obs., Kamuela, Hawaii), and Harold G. Loomis *In* Atlantic Oceanog. and Meteorol. Labs. Collected Reprints, 1969, vol. 2 Sep. 1970 15 p refs Repr. from Solar Phys. (Netherlands), v. 10, 1969 p 135-149 (See N71-36973 23-20)
Copyright. Avail: SOD $3.75

N71-37407*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTRODUCTION TO SOLAR PHYSICS
J. C. Brandt *In its* Phys. of the Solar System Jun. 1970 p 1-23 (See N71-37406 23-30)
Avail: NTIS HC $6.00/MF $0.95 CSCL 03B

N71-37408*# Princeton Univ., N.J. Joseph Henry Labs.
INTERNAL ROTATION OF THE SUN
R. H. Dicke *In* NASA. Goddard Space Flight Center Phys. of the Solar System Jun. 1970 p 25-62 refs (See N71-37406 23-30)
Avail: NTIS HC $6.00/MF $0.95 CSCL 03B

N71-37409*# Columbia Univ., New York.
A HISTORY OF SOLAR ROTATION
E. A. Speigel *In* NASA. Goddard Space Flight Center Phys. of the Solar System Jun. 1970 p 63-91 refs (See N71-37406 23-30)
(Grant NSF GP-18062)
Avail: NTIS HC $6.00/MF $0.95 CSCL 03B

N71-37410*# Los Alamos Scientific Lab., N.Mex.
DYNAMICS OF THE OUTER SOLAR ATMOSPHERE
A. J. Hundhausen *In* NASA. Goddard Space Flight Center Phys. of the Solar System Jun. 1970 p 93-157 refs Sponsored by AEC (See N71-37406 23-30)
Avail: NTIS HC $6.00/MF $0.95 CSCL 03B

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N71-37401*# Rensselaer Polytechnic Inst., Troy, N.Y. School of Engineering.
ANALYSIS AND DESIGN OF A CAPSULE LANDING SYSTEM AND SURFACE VEHICLE CONTROL SYSTEM FOR MARS EXPLORATION Progress Report, 1 Jul. 1070 - 30 Jun. 1971
D. K. Frederick, P. K. Lashmet, G. N. Sandor, C. N. Shen, E. J. Smith et al 30 Jun. 1971 106 p refs
(Grant NGL-33-018-091)
(NASA-CR-122950; RPI-TR-MP-23) Avail: NTIS CSCL 22B

Investigation of problems related to control of a mobile planetary vehicle according to a systematic plan for the exploration of Mars has been undertaken. Problem areas receiving attention include: (1) overall systems analysis; (2) vehicle configuration, (3) dynamics and attitude control; (4) vehicle power systems analysis; (5) on-board navigation systems; (6) satellite-vehicle navigation systems; (7) terrain sensing, interpretation and modeling; and (8) chromatographic systems design concept studies. The specific tasks which have been undertaken are defined and the progress which has been achieved is summarized. Author

N71-37402*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
STELLAR CALIBRATION OF L-/S-BAND AND VHF RECEIVING SYSTEMS
Ralph E. Taylor Jul. 1971 46 p refs Presented at the Telementry Working Group; Inter-range Instrumentation Group, Santa Maria, Calif., Jul. 1971
(NASA-TM-X-67379) Avail: NTIS CSCL 03B

An antenna calibrating method using the absolute flux density from either Cassiopeia A or Cygnus A is described for STADAN stations in the Northern Hemisphere. Measurements are made at 137, 402, and 1702 MHz. Effective antenna gain, system noise temperature, and the gain-to-noise temperature ratio are determined to better than one decibel. The stellar noise

flux density is sufficient to calibrate a paraboloidal dish antenna as small as 20 feet in diameter, and dish antennas ranging up to 85 feet in diameter can be calibrated without a beam correction factor. A statistical error analysis, considering the propagation of precision indexes, is given. N.E.N.

N71-37403*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MARINER MARS 1969 FINAL PROJECT REPORT. VOLUME 3: SCIENTIFIC INVESTIGATIONS
J. A. Stallkamp, A. G. Herriman et al 15 Sep. 1971 103 p refs 3 Vol.
(Contract NAS7-100)
(NASA-CR-122090; JPL-TR-32-1460-Vol-3) Avail: NTIS CSCL 22C

This is the third of three volumes of the Mariner Mars Project report. It describes the scientific program and lists the initial publications of the investigator teams. The scientific mission of the Mariner 6 and 7 project consisted of the design of the six selected experiments, the construction of four instruments and their incorporation into the spacecraft, the selection of flyby dates and aiming points for the spacecraft and pointing strategy for instruments, and the acquisition, return, and analysis of data. Results of postflight analysis of the mission scientific data are presented. For Volumes 1 and 2, see N71-15484 and N71-20460, respectively. Author

N71-37404*# Cornell Univ., Ithaca, N.Y. Lab. for Planetary Studies
THE PHYSICAL MEANING OF PHASE COEFFICIENTS
J. Veverka Mar. 1971 24 p refs Presented at the IAU Colloq. Phys. Studies of Minor Planets, Tucson, Ariz., 8-10 Mar. 1971
(Grant NGR-33-010-082)
(NASA-CR-122920; CRSR-441) Avail: NTIS CSCL 03B

Information about an asteroid's surface contained in a measurement of the phase coefficient between phase angles of 10 and 30 deg is examined. It is shown that absolute reflectivities cannot be derived from phase coefficients. The observed phase coefficient may depend as much on the photometric properties of an individual surface element as on the degree of large-scale surface roughness, and these two effects are impossible to separate if only disk integrated measurements are available. The wavelength dependence of asteroid phase coefficients should be small and contain little important information about the surface. In the case of very irregular asteroids with macroscopically rough surfaces the importance of large-scale shadowing and the observed phase coefficient will depend on the aspect of the asteroid. It should, in some cases, be possible to estimate the relative surface roughness of two quasi-spherical asteroids by combining photometric and polarimetric observations. Author

N71-37405*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO 14 MISSION, 6 DAY REPORT
Feb. 1971 27 p
(MSC-03988; NASA-TM-X-67256) Avail: NTIS CSCL 22C

A brief evaluation of preliminary data for the Apollo 14 flight is presented. Summaries of prelaunch atmospheric electricity and lunar scientific experiments are included as well as inflight demonstrations, the trajectory, command and service module performance, lunar module performance, the extravehicular mobility unit, the flight crew, a biomedical evaluation, and mission support performance. J.M.

N71-37406*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PHYSICS OF THE SOLAR SYSTEM
Jun. 1970 615 p refs Presented at 4th Summer Inst. for Astronomy and Astrophys., Stony Brook, N. Y., 17 Jun. - 15 Jul. 1970
(NASA-TM-X-65702; X-630-71-380) Avail: NTIS HC $8.00/MF $0.95 CSCL 03B

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N71-37407*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTRODUCTION TO SOLAR PHYSICS c29
J. C. Brandt *In its* Phys. of the Solar System Jun. 1970 p 1-23 (See N71-37406 23-30)
Avail: NTIS HC $8.00/MF $0.95 CSCL 03B

The basic physics involved in the large-scale structure of the sun's interior and atmosphere is reviewed. The fundamental physical properties are listed, and the hydrogen convection zone, photosphere, chromosphere, and corona are considered seperately. Emphasis is on the photosphere and its radiative transfer, absorption, structure, and abundances. N.E.N.

N71-37408*# Princeton Univ., N.J. Joseph Henry Labs.
INTERNAL ROTATION OF THE SUN c29
R. H. Dicke *In* NASA. Goddard Space Flight Center Phys. of the Solar System Jun. 1970 p 25-62 refs (See N71-37406 23-30)
Avail: NTIS HC $8.00/MF $0.95 CSCL 03B

Observations in support of the rotation of the deep solar interior and a model accounting for the observations are discussed. The observations include a solar oblateness of 0.00005, the independence of latitude of the photospheric brightness, magnetic and velocity field distributions in the photosphere, solar wind structure, rotation in F and G type stars in young clusters, and lithium and beryllium abundance in the sun and solar-type stars of young clusters. The model is developed assuming the following: (1) The sun is a typical star of 1 solar mass. (2) The core has a radius approximately 0.85 solar radius and rotates at an angular velocity 20 times greater than the surface. (3) The sun arrived on the main sequence with the surface rotation slowed to about 5 times the present surface value, but with the core rotating uniformly at 20 times the present surface rate. (4) The young sun had a ratio of solar wind torque to surface angular velocity roughly an order of magnitude greater than its present value. (5) The enhanced torque decayed with time. The core radius is required to be > 0.5 solar radius

where Be is burned and < 0.58 solar radius where Li-7 is burned. N.E.N.

N71-37409*# Columbia Univ., New York.
A HISTORY OF SOLAR ROTATION c29
E. A. Spiegel *In* NASA. Goddard Space Flight Center Phys. of the Solar System Jun. 1970 p 63-91 refs (See N71-37406 23-30)
(Grant NSF GP-18062)
Avail: NTIS HC $6.00/MF $0.95 CSCL 03B

The evolution of the solar rotation rate from the initial state of rigid rotation, the end of Hayashi phase, is discussed. The effects of convection and convective instability on the slowing of the rotation rate and the solar structure are considered, and details are given on hydromagnetic mechanisms spin-down theories. Problems related to solar spin-down are identified as surface lithium abundance, magnetic field in the interior, and helium mixing. N.E.N.

N71-37410*# Los Alamos Scientific Lab., N.Mex.
DYNAMICS OF THE OUTER SOLAR ATMOSPHERE c29
A. J. Hundhausen *In* NASA. Goddard Space Flight Center Phys. of the Solar System Jun. 1970 p 93-157 refs Sponsored by AEC (See N71-37406 23-30)
Avail: NTIS HC $6.00/MF $0.95 CSCL 03B

The dynamic processes which produce the corona and its expansion into interplanetary space, the resulting relationship between solar and interplanetary phenomena, and the use of interplanetary observations to infer coronal properties are discussed. Physical processes in the outer atmosphere are considered with respect to energy sources, mechanical dissipation, and heating by acoustic waves. The structure of the transition zone is mentioned, and mathematical models are given for the expansion of the outer atmosphere into the interplanetary region. Two theoretical models relating the interplanetary, coronal, and photospheric ionic abundances are given based on the abundance of helium ions or on the ionization and recombination of oxygen ions. The propagation of flare-associated shock waves through the solar wind is also discussed. N.E.N.

N71-37411*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE INTERPLANETARY PLASMA
K. Ogilvie *In its* Phys. of the Solar Systems Jun. 1970 p 159-198 refs (See N71-37406 23-30)
Avail: NTIS HC $6.00/MF $0.95 CSCL 03B

Observational data on interplanetary plasma and diagnostic methods are discussed. The Debye length of several meters and the low frequency of collisions, such that the plasma may be considered collisionless, are important for diagnostic purposes. The velocity distribution function is approximated for as many species as possible over a limited range of velocity and angle at one or two points in space. Different ionic species in the solar wind are described, and the separation of He-4 and H ions is emphasized. Observations of the solar wind during solar quiet and solar active times are discussed in detail. N.E.N.

N71-37412*# Kitt Peak National Observatory, Tucson, Ariz.
LOWER ATMOSPHERES OF THE PLANETS
Donald M. Hunten *In* NASA. Goddard Space Flight Center Phys. of the Solar System Jun. 1970 p 199-244 refs (See N71-37406 23-30)
Avail: NTIS HC $6.00/MF $0.95 CSCL 03B

The lower atmospheric composition, and thermal and pressure structure of Mars, Venus, and Jupiter are discussed. The basic equations are presented for the relations of equilibrium temperatures, barometric equations, integrated densities, adiabatic temperature gradient, and radiative heat transfers. The Martian atmosphere is thin, mostly carbon dioxide, free of extensive cloudiness, and transparent to the bulk of the solar radiation; theoretical models of its circulation are described. The Venusian atmosphere is mainly carbon dioxide and is characterized by total cloud cover; the high surface temperature and models for the circulation are considered. The Jovian atmosphere is primarily molecular hydrogen and is dominated by clouds believed to be ammonia ice. The general atmospheric structures of Saturn, Uranus, and Neptune resemble that of Jupiter. The low atmospheric pressure and temperature of Mercury are mentioned. N.E.N.

N71-37413*# State Univ. of New York, Stony Brook. Dept. of Earth and Space Sciences.
THE COMPOSITION OF PLANETARY ATMOSPHERES
Tobias Owen *In* NASA. Goddard Space Flight Center Phys. of the Solar System Jun. 1970 p 245-269 refs (See N71-37406 23-30)
Avail: NTIS HC $6.00/MF $0.95 CSCL 03B

The composition of planetary atmospheres, emphasizing the outer planets, and of comets is discussed, and the absorption spectrum analysis is described. The amounts of H2, CH4, and NH3 in the Jovian atmosphere over the North Equatorial Belt are mentioned. The best results of H2 and CH4 content for Saturn and Uranus, and of CH4 for Neptune and Pluto are tabulated. Recent space probe and ground based data on the Martian and Venusian atmospheres are reviewed, particularly on the water vapor problem. A study of the molecular emission lines of cometary spectra indicates that they arise from radicals such as C2, C3, CN, and OH. The spectra of Tago-Sato-Kosaka and Bennett comets are also discussed. It is felt that the atmospheres of Venus, Earth, and Mars evolved similarly from crustal outgassing. N.E.N.

N71-37414*# Princeton Univ., N.J.
INTERIOR STRUCTURE OF GIANT PLANETS
R. Smoluchowski *In* NASA. Goddard Space Flight Center Phys. of the Solar System Jun. 1970 p 271-296 refs (See N71-37406 23-30)
Avail: NTIS HC $6.00/MF $0.95 CSCL 03B

Recent developments in the study of the planetary interiors are reviewed, with emphasis on Jupiter. Models of Jupiter are described which consider the helium and hydrogen equations of state, the helium-hydrogen equilibrium, thermal structure and heat emission, and the Red Spot. Saturn's interior is believed to be qualitatively similar to Jupiter's, but differs in that the phase change between molecular and metallic solid hydrogen occurs at a relatively smaller radius and the helium-rich core has a radius relatively much larger. Three models for studying Uranus and Neptune are a completely homogeneous model; a two-shell model with a core of rock and ice surrounded by H, He, and Ne; and a three-shell model consisting of an inner rock core, an ice mantle, and an outer H, He, and Ne layer. N.E.N.

N71-37415*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RADAR AND RADIO EXPLORATION OF THE PLANETS
Arvydas J. Kliore *In* NASA. Goddard Space Flight Center Phys. of the Solar System Jun. 1970 p 297-351 refs (See N71-37406 23-30)
Avail: NTIS HC $6.00/MF $0.95 CSCL 03B

Passive radio, radar, and radio occultation observations are discussed. The theoretical considerations in using passive radio for planetary brightness temperature measurements are described, and calculated temperatures are given. Continuous wave monochromatic and pulse modulated radar signals are used to obtain planetary data. Measurements are presented of rotation rate, surface scattering, and topology of Venus, and topology of Mars, Mercury, and Jupiter. The radio occultation method is based on measurements of changes in phase, frequency, and amplitude of microwave signals from a spacecraft transmitter introduced by planetary atmospheric refraction. In addition to refractivity, data on diffraction, attenuation, and absorption may be obtained. Data observed with signals from Mariners 4, 6, and 7 are given for Mars, and with Mariner 5 signals for Venus. N.E.N.

N71-37416*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
NATURE AND INTERPRETATION OF THE APOLLO 11 LUNAR SAMPLES
J. A. Wood *In* NASA. Goddard Space Flight Center Phys. of the Solar System Jun. 1970 p 353-412 refs (See N71-37406 23-30)
Avail: NTIS HC $6.00/MF $0.95 CSCL 03B

Lunar geology, properties of Apollo 11 soils, and preliminary interpretations of the samples are discussed. Cratering is considered the most important mechanism in shaping the lunar surface, and details are given on the mechanics of individual cratering events, systems of interacting craters, regolith development, and cratering effect on lunar material. Geologic interpretation of lunar photographs is described, and a simplified geologic map in which only the fundamentally different types of bedrock are indicated is presented. The soils examined were mostly tiny rock fragments in the mm range. The large majority of the rock (94.1% by weight) was basalt from the bedrock of the mare. The presence of anorthosites (5.0%) was unexpected, and it is felt that they came from the highlands. The geologic problems presented by the anorthosites are discussed and it is suggested that the moon had a partially molten layer at its surface early in its history. The implications resulting from this hypothesis are described. N.E.N.

N71-37417*# Institut d'Astrophysique, Paris (France).
ORIGIN OF THE SOLAR SYSTEM
E. Schatzman *In* NASA. Goddard Space Flight Center Phys. of the Solar System Jun. 1970 p 413-455 refs (See N71-37406 23-30)
Avail: NTIS HC $6.00/MF $0.95 CSCL 03B

A theory of the origin of the solar system and the evolution of a primitive nebula is presented. It is assumed that the proto-sun was similar to a flare star. Stellar rotation and the formation of a primitive nebula from the contraction of a rotating body are described. The physical conditions and hydrogen formation in the primitive nebula, and formation of primary bodies in it are discussed. Angular momentum and the law of planetary distances, and spallation as the origin of light elements are also considered. N.E.N.

N71-37418*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
EVOLUTION OF PLANETARY ATMOSPHERES
S. I. Rasool *In its* Phys. of the Solar System Jun. 1970 p 457-489 refs Submitted for publication (See N71-37406 23-30)
Avail: NTIS HC $6.00/MF $0.95 CSCL 03B

The present composition and the evolution of the atmospheres of the Earth, Mars, Venus, and Jupiter are discussed. The most important mechanism by which a planet acquires an atmosphere is considered to be the capturing of gaseous atoms and molecules into its gravitational field at the time of accretion. The most important process of adding molecules to the earth atmosphere is volcanic activity, and in prebiological history free oxygen was supplied only by photodissociation of water. The decisive factor in producing the Venus atmosphere is the greenhouse effect due to the dominance of carbon dioxide. The Mars atmospheric model suggests that there never were oceans but that they may accumulate when the atmospheric pressure becomes large enough for the greenhouse effect to raise the temperature above 273 K. Composition, pressure, and temperature data of Jupiter atmosphere are given. Space probe data and the possibility of extraterrestrial life are also discussed. N.E.N.

N71-37419*# California Univ., Los Angeles. Dept. of Astronomy.
HISTORY OF THE LUNAR ORBIT
Peter Goldreich *In* NASA. Goddard Space Flight Center Phys. of the Solar System Jun. 1970 p 491-530 refs (See N71-37406 23-30)
(Grant NGR-05-007-002)
Avail: NTIS HC $6.00/MF $0.95 CSCL 03B

The principal dynamic features of the earth-moon-sun system in the absence of tidal forces are described. Equations are derived for the precessional motions of the moon's orbital plane and the earth's equatorial plane. The natural satellites are studied considering precessional motion. It is found that all satellites closer than a critical distance to the planet, except Triton, move in equatorial orbits and those outside the critical distance are nonequatorial. It is suggested that the equatorial satellites were formed by accretion. The slow changes in the motion in the earth-moon system produced by solar- and lunar-induced tides on earth are calculated. The equations of motion are solved by numerical integration using a Runge-Kutta method. Lunar orbital eccentricity and the need for an accurate tidal torque determination are mentioned. It is concluded that the calculations do not support any current theory of lunar origin. However, the most attractive possibility appears to be formation by accretion between 10 and 30 earth radii. N.E.N.

N71-37420*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE EFFECT OF GALACTIC MAGNETIC FIELD LINE WANDERING ON COSMIC-RAY PARAMETERS
Frank C. Jones Jun. 1971 13 p refs Presented at the 12th Intern. Conf. on Cosmic Rays, Hobart, Australia, 1971
(NASA-TM-X-65696; X-641-71-371) Avail: NTIS CSCL 03B

A probability density for the end points of the flux tube passing through the earth employing the theory of Gaussian processes was calculated and used to calculate the probability densities of cosmic ray parameters based on a smoothed out source, one dimensional diffusion model. It is seen that these parameters have a very wide range of fluctuation but that even when the mean age is confined to a narrow range the mean and most probable value of the streaming velocity is zero. From this it is argued that a very small observed value for the cosmic ray anisotropy requires no special explanation any more than would any other value compatible with the probability distribution.
Author

N71-37421*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TERRESTRIAL AND LUNAR ANALOGUES OF MARTIAN TOPOGRAPHY
Paul D. Lowman, Jr. Sep. 1971 56 p refs Submitted for publication
(NASA-TM-X-65695; X-644-71-380) Avail: NTIS CSCL 03B

A comparison was made among Mariner 6 and 7 photographs of Mars and orbital photographs of the earth and moon to investigate similarities in Martian terrain features and terrestrial or lunar features of comparable size. Five general categories of similarity were identified. Tectonic basins were inferred to exist on Mars from the similarity of the border scarps of the Hellas basin to fault scarps of the Brokeoff Mountains in New Mexico. Crustal collapse structures were inferred from the general similarity of the Martian chaotic terrain to the physiography of the eastern Mojave Desert and the Afar depression. Eolian deposits of sand on Mars were suggested by the similarity of light areas previously mapped as chaotic terrain to linear ergs in the western Sahara; however, there should be gradations between chaotic terrain and sand filled depressions. Mare ridges, essentially identical to those of lunar maria were found in one Mariner photograph, suggesting that the Martian crust may be volcanic despite the apparent absence of moon like maria. A sinuous rille system of over 200 km long was found on one Mariner photograph; the absence of evidence for fluvial erosion suggests that both Martian and lunar sinuous rilles are of internal origin.
Author

N71-37422*# National Aeronautics and Space Administration, Washington, D.C.
SPACE MARATHON
V. Kitain, comp. Sep. 1971 181 p Transl. into ENGLISH of

the book "Kosmicheskiy Marafon" Moscow, Izvestiya Press, 1970 p 1-239
(NASA-TT-F-13786) Avail: NTIS CSCL 22C

A day-by-day account is presented of the flight of the Soyuz 9 spacecraft. Particular emphasis is placed on the extensive progjem of scientific research and biomedical experiments conducted by the cosmonauts during the 18 days of orbital flight. In addition to the reports given by the cosmonauts during communication with ground stations, commentaries by Soviet scientists concerning the significance of the research are also presented. D.L.G.

N71-37423*# Avco Corp., Wilmington, Mass.
A STUDY OF A JUPITER ATMOSPHERIC ENTRY PROBE MISSION. VOLUME 2: TECHNICAL SUMMARY
13 Aug. 1971 294 p refs
(Contracts NAS7-100; JPL-952897)
(NASA-CR-122986; AVSD-0372-71-RR-Vol-2) Avail: NTIS CSCL 22A

A study was conducted to satisfy the following set of objectives: (1) to screen a large number of Jupiter entry probe missions, (2) to generate configuration descriptions, and (3) to identify both mission studies and technology developments that are worthwhile to enhance the feasibility and improve the success of the mission. A principal groundrule has been entry probe survival to the base of the cloud layer with remote sensing to provide information at greater atmospheric depths. This approach to the study of a Jupiter atmospheric entry probe is significantly different than the equally valid approach of entry probe survival to great depths with an in situ sensing. For example, in the nominal Jovian atmosphere the base of the clouds occur at a pressure of 17 atm and the ambient temperature of this level is 425 deg K. Deep descent is considered to be the 1000 atm level and the corresponding ambient temperature is 1425 deg K. Author

N71-37424*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
IMPLICATIONS OF REGOLITH THICKNESS IN THE APOLLO 16 LANDING SITE
Verne R. Oberbeck Oct. 1971 18 p refs
(NASA-TM-X-62089) Avail: NTIS CSCL 03B

The thickness of the regolith in the Apollo 16 landing site was studied to suggest certain areas where substrate samples may be obtained and to compare the results with predictions of regolith thickness calculated from the Monte Carlo impact cratering model. These comparisons will be used to offer several alternative interpretations of the recent geologic history of the landing site. Author

N71-37425*# National Aeronautics and Space Administration, Washington, D.C.
WATER ON EXTRATERRESTRIAL OBJECTS [WASSER AUF EXTRATERRESTRISCHEN OBJEKTEN]
H. Woehl Oct. 1971 9 p Transl. into ENGLISH from Sterne und Weltraum, v. 10, Apr. 1971 p 93-95
(NASA-TT-F-13835) Avail: NTIS CSCL 03B

The spectral analysis methods used for detecting water on celestial bodies are described, and the possible abundance of water on planets and stars are discussed. Schubert's theory of water erosion on the lunar surface is reconsidered, and the possible existence of ice and water on the moon is suggested. The current evidence of water abundances on other planets of the solar system is reviewed. Synthesis of water in a stellar atmosphere as a function of temperature and concentrations of component elements is examined. The existence of water on cool stars and in interplanetary space is quoted. The possible synthesis of water within the umbrae of sunspots is discussed. Author

N71-37426*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A GENERAL ALGORITHM FOR THE SOLUTION OF KEPLERS EQUATION FOR ELLIPTIC ORBITS
Edward W. Ng 15 Jan. 1971 20 p refs
(Contract NAS7-100)
(NASA-CR-122933; JPL-TM-33-496) Avail: NTIS CSCL 03C

An efficient algorithm and subroutine are presented for the solution of Kepler's equation f(E) = E-M-esinE = 0, where e is the eccentricity, M the mean anomaly and E the eccentric anomaly. This algorithm is based on simple initial approximations that are cubics of M, and an iterative scheme that is a slight generalization of the Newton-Raphson method. An extensive testing involving 20,000 pairs of values of e and M show that for single precision 42.0% of the cases require one iteration, 57.8% two, and 0.2% three. Both single and double precision FORTAN 5 subroutine listings are provided for the (Univac) 1108 computer, the D. P. one requiring one additional iteration. Author

N71-37427*# National Aeronautics and Space Administration, Manned Spacecraft Center, Houston, Tex.
APOLLO 15 MISSION 5-DAY REPORT
Aug. 1971 46 p
(NASA-TM-X-67381; MSC-04768) Avail: NTIS CSCL 22C

Details of the Apollo 15 mission are briefly summarized and results of an evalution of preliminary data from inflight and surface experiments are reported. The performance of various extravehicular, communication, module, and support systems is discussed. Tables are included which summarize the sequence of events and spacecraft maneuvers performed during the mission. J.G.M.

N71-37428# Academy of Sciences (USSR), Moscow. Scientific Commission on the Problem of Cosmic Rays.
PROCEEDINGS OF THE SIXTH ANNUAL ALL-UNION WINTER SCHOOL ON SPACE PHYSICS, PART 1
S. N. Vernov, ed., G. Ye. Kocharova, ed., and S. M. Kirova, ed. Apatity, Murmansk, USSR 1969 272 p refs In RUSSIAN Presented at Apatity, Murmansk, USSR, 18 Mar. - 1 Apr. 1969
Avail: NTIS

Principles of nuclear and plasma physics are discussed in relation to stellar and solar processes. The correlation between solar phenomena and magnetospheric activity is considered. For individual titles, see N71-37429 through N71-37475.

N71-37429# Academy of Sciences (USSR), Moscow.
THE APATITY SCHOOL, THE FIRST STAGE IN THE HISTORY OF COSMIC PHYSICS
G. Ye. Kocharov *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 3-11 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

The first five years in the history of the School for Space Physics are reviewed. The main purpose of the school is to consider the scope and perspectives of space physics and the various directions possible for research. The program of the sixth meeting is discussed in detail. Topics considered were anisotropy of cosmic rays in interplanetary space, methods of studying cosmic ray variations, solar cosmic rays, the solar wind, the earth's magnetosphere, and operational considerations for cosmic ray observation stations. A general discussion of each of the papers is presented. Transl. by K.P.D.

N71-37430# Academy of Sciences (USSR), Moscow.
ISOTROPISM OF HETEROGENEOUS COSMOLOGIC MODELS WITH CENTRAL SYMMETRY
V. A. Ruban and A. D. Chernik *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 15-25 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

An initial, unique structure for the expanding universe provides a special example for cosmologic solutions to the Einstein equations. These represent a large family of homogeneous anisotropic models which, in the early stages of

evolution of the universe, are uniquely and significantly characterized by the nonequivalence of different space directions. In the later stages of development, they do not contradict the observed isotropy of the metagalaxy. The possibility is indicated for the development of an isotropic and homogeneous metagalaxy from a totally nonhomogeneous, anisotropic, and unique structure with infinite density gradient and galactic material velocity. The hypothesis of central symmetry of distribution and motion of gravitational matter is sufficiently generalized if the metagalaxy is taken to be a gigantic, finite, organic system with a relativistic gravitational force field. An idealized variant of the cosmologic models of a sphere composed of uncompressed dust is considered, for which there is an exact analytical solution in the gravitational equations. The absence of significant anisotropy and heterogeneity in the metagalaxy is inferred.
Transl. by K.P.D.

N71-37431# Academy of Sciences (USSR), Moscow.
THE FORMATION OF GALAXIES IN AN EXPANDING UNIVERSE
A. G. Doroshkevich *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 26-31 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

Three aspects are considered: the origin of initial disorder in the early stages of expansion, the evolution of disorder during expansion, and the formation of galaxies and galactic clusters. In the hot model, density, velocity, and metric expansion are adiabatic and entropic, velocity and metric expansion are reversible, and metric expansion is of the gravitational wave type. A major problem to consider is what portion of the matter in the universe is transferred to the galaxies. The mass distribution of galaxies and galactic clusters must be determined. Galactic and cluster rotation must be studied, as well as the origin of a magnetic field during the process of galaxy formation.
Transl. by K.P.D.

N71-37432# Academy of Sciences (USSR), Moscow.
THE SEPARATION OF GALAXIES INTO SPHERICAL AND PLANAR SUBSYSTEMS
L. E. Gurevich and A. D. Chernin *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 32-34 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

Spiral galaxies contain both slowly rotating spherical subsystems and quickly rotating planar ones (disks). The origin of these subsystems from a primordial protogalactic cloud may be inferred. A system in which gravitational interactions are the major cohesive force undergoes a unique evolution, characterized by what is called an elastic process and leading to a spherical shape. A system whose force is not gravitational, but contact collisional, undergoes an inelastic evolution leading to a planar shape. These evolutionary processes occur both in concentrated star systems and in systems made up of stars and gas clouds. Protogalactic evolution is governed by elastic interaction of stars and star clusters in large gas clouds and by inelastic interactions of gas clouds with each other.
Transl. by K.P.D.

N71-37433# Academy of Sciences (USSR), Moscow.
GALACTIC AGGREGATION AND THE EXPANSION OF THE COSMOS
A. D. Chernin *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 35-40 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

A major problem in the study of galactic clusters is whether they are the results of an explosion or of condensation. The kinetic energy of clusters is discussed. The early stages of metagalactic expansion are characterized by high temperature, high matter density, and radiation. A definite structuring characterized by isotropy and/or homogeneity must have existed in the early metagalactic stages and evolved to yield the present-day nonhomogeneous density in the form of galaxies and clusters. Gravitational condensation accounts for the fact that along with expanding clusters, there are galactic systems, having a negative total energy, which must have undergone an evolutionary process similar to the condensation of a gravitationally cohesive gas cloud. On the other hand, cases are known of violent explosions in galaxies, accompanied by expulsion from their nuclei of a significant mass of material and sometimes even of compact blobs like dwarf galaxies.
Transl. by K.P.D.

N71-37434# Academy of Sciences (USSR), Moscow.
THE POSSIBILITY OF VERIFYING THE THEORY OF GRAVITATION BY MEANS OF COSMOLOGY
A. M. Finkelshteyn *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 41-44 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

The construction of a cosmologic scheme which is observable within the region of extragalactic astronomy requires a series of general propositions concerning the structure of the universe, deduced from the framework of the gravitational theory. The method, analogically presented, accounts for observed dependence on Hoyle's theory by the generalized L-term and is formulated in a general covariant form. A derivation is presented which is applicable to several forms of the theory of gravitation.
Transl. by K.P.D.

N71-37435# Academy of Sciences (USSR), Moscow.
STELLAR GAS EMISSION DURING THE LATE STAGES OF EVOLUTION
G. S. Bisnovatyy-Kogan *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 45-48 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

The hydrodynamics of gas flow is considered in relation to emission from stars close to the main sequence. Mass loss occurs in all stages of stellar evolution, but it is most significant in the last stages. Although the variables of velocity and velocity of mass loss are allowed in the consideration of the gas envelope, due to the transfer conditions at a common point and the satisfaction of these conditions at infinity, the emission envelope is determined by the solution of only two variables, the system made up of particles and the critical density, which is in turn determined from the joint conditions.
Transl. by K.P.D.

N71-37436# Academy of Sciences (USSR), Moscow.
STUDY OF LOW FREQUENCY OSCILLATIONS IN THE MAGNETIC FIELD OF A ROTATING NEUTRON STAR
Yu. V. Vandakurov *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 49-55 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

Neutron stars may have nonconstant, nonradial, low frequency oscillations of a convective nature, if their internal magnetic field decreases rapidly from the center to the periphery. Oscillation equations for an ideally conducting rotational configuration with a toroidal-type field are considered. Precession and field are considered small perturbations. Effects of the general theory of relativity are not considered. The results obtained verify the possible existence of an instability. Self-variable, nonsymmetric oscillations, dependent on the axis of rotation, are not all similar to convective ones. In particular, their region of instability is significantly greater. Equations are derived for the equilibrium state, for general low frequency oscillations, and for low frequency oscillations in a infinite gravitational cylinder. Stellar stability with a toroidal magnetic field is considered.
Transl. by K.P.D.

N71-37437# Academy of Sciences (USSR), Moscow.
FIELD GENERATION IN MAGNETIC STARS
E. M. Drobyshevskiy *In its* Proc. of the 6th Ann. All-Union

Winter School on Space Phys., Part 1 1969 p 56-57 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

Stars possessing a magnetic field are in general peculiar stars of the spectral classes F2-B8. They have a shallow convective envelope which is absent in earlier stars. The degree of ionization in the zone of convection is high enough so that the gas is estimated to be fully ionized. Plasma accelerator models can be applied to these stars. In the convective zones the stellar matter undergoes acceleration in all possible directions. Convection is characterized by an equation for zero total mass flow across a surface of arbitrary radius. Equations are developed for flow density in layered models. The case for a convective envelope dealing with a significant stellar volume is considered. This is applicable to late stars, including the sun. Mixing may arise in the magnetic field itself if its configuration is far removed from the configuration corresponding to stationary flow distribution. Transl. by K.P.D.

N71-37438# Academy of Sciences (USSR), Moscow.
THE SPECTRUM OF EXTRAGALACTIC BACKGROUND RADIATION
R. A. Syunyayev *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 58-64 refs In RUSSIAN (See N71-37428 23-30)
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The entire spectrum of electromagnetic radiation, from the radio range to the gamma region, and its properties are considered. Possible sources for each radiation type are also discussed. Transl. by K.P.D.

N71-37439# Academy of Sciences (USSR), Moscow.
CALCULATION OF STELLAR OPACITY AND AN ESTIMATE OF LINEAR LIGHT ABSORPTION
A. F. Nikiforov and V. B. Uvarov *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 65-69 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

The effective cross sections of photon absorption and scattering were calculated. Relativistic effects and spectral line shift due to fluctuation of charge numbers were taken into account in the determination of spectral line absorption. Effects connected with the deviation of a self-consistent field from a central symmetric one were neglected. The effective cross sections of photon absorption processes were calculated in a nonrelativistic dipole approximation. The formulas for photoionization may be derived using the corresponding maximum transfer from the expression for line absorption cross sections. Therefore, it is possible to effectively calculate discrete-discrete transfer for overlapping lines using the photoionization formula.
Transl. by K.P.D.

N71-37440# Academy of Sciences (USSR), Moscow.
THE CHARGE SYMMETRY OF THE UNIVERSE
N. A. Vlasov *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 69-72 refs In RUSSIAN (See N71-37428 23-30)
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Symmetry implies that the sum charge of particles and antiparticles is equal to zero and that the universe may be considered to be neutral with respect to charge. If it is assumed that the present-day universe is charge symmetric with sum charge equal to zero, matter and antimatter bodies must be equally probable but distributed in space such that they are separated from each other. The mechanisms of separation, within the framework of the hot model of the universe, have yet to be discovered, and the absence of observed data disclosing the presence of antimatter must be explained. If the universe is charge symmetric, then matter-antimatter collisions are more probable at its center, producing annihilation and accompanying gamma radiation from pion decay. Transl. by K.P.D.

N71-37441# Academy of Sciences (USSR), Moscow.
STUDY OF GAMMA RADIATION BY THE COSMOS 135 SATELLITE IN CONNECTION WITH POSSIBLE ANTIMATTER METEOR STREAMS
B. P. Konstantinov, R. L. Aptekar, M. M. Bredov, S. V. Golenetskiy, Yu. A. Guryan et al *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 73-84 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

A method is described for radiation correlation between intensities of stable gamma quanta and neutrons at heights of 12-18 km for various meteors entering the earth's atmosphere. The results obtained may be considered as support for the proposed hypothesis concerning antimatter comets and associated meteor streams. The intensity of electron-positron annihilation radiation during Geminid, Ursid, and Quadrantid meteor streams was investigated in the course of a study of spectra and gamma ray intensity in near-earth space. The apparatus and measurement techniques are described. Integral measurements of gamma rays and charged particles, and streams of annihilation gamma radiation with energies of 0.511 MeV, are discussed. A statistical analysis of the results is presented. Observations of solar and meteor activity are also considered. Transl. by K.P.D.

N71-37442# Academy of Sciences (USSR), Moscow.
DETERMINING THE NUMBER OF ANTIPROTONS IN PRIMARY COSMIC RADIATION c29
E. A. Bogomolov, V. K. Karakadko, N. D. Lubyanaya, V. A. Romanov, M. G. Totubalina et al *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 85-88 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

Measurement of east-west symmetry in the 3-20 BeV region was done by balloon and rocket sounding, using telescopes with Geiger and directional Cerenkov counters. The experimental significance of asymmetry is that primary cosmic radiation consists only of protons and that the magnetic field of the earth is dipolar. In every case, the experimental value of asymmetry is less than the calculated one. This may be accounted for by the presence of about 10% antiprotons in cosmic rays. Transl. by K.P.D.

N71-37443# Academy of Sciences (USSR), Moscow.
GEOCHEMICAL PRINCIPLES IN RELATION TO THE COMPOSITION OF THE COSMOS AND THE ORIGIN OF ATOMIC NUCLEI
V. V. Cherdyntsev *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 89-93 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

General distribution rules for atomic nuclei are presented. Nucleogenetic theories and their application to stellar evolution are reviewed. Heavy isotopes (A greater than 209) are considered in relation to nucleogenesis. Transl. by K.P.D.

N71-37444# Academy of Sciences (USSR), Moscow.
PROPERTIES OF NUCLEI DISCHARGED FROM BETA STABILITY POLES c29
Ye. E. Berlovich *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 94 In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

The number of nuclides within the boundaries of nuclear stability sometimes exceeds the number of nuclides in the vicinity of beta stability poles. These nuclides are continuously synthesized in various processes in cosmic objects, such as in rapid neutron capture during supernova explosions, and in deep splitting and separation reactions due to high energy proton activity. They play a significant role in the evolution of matter in the universe. Their study is important both for astrophysics and for the construction of an adequate nuclear theory. These nuclei differ from nuclei near beta stability poles in their relations

between neutrons and protons, between Coulomb and nuclear forces, and between the energy relations of two nucleon types. They may also differ in the distribution radii of two nucleon types, in addition to their having large beta decay energies.

Transl. by K.P.D.

N71-37445# Academy of Sciences (USSR), Moscow.
COSMIC GAMMA AND X-RAY RADIATION c29
S. I. Syrovatskiy *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 97-110 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

Discrete X-ray sources and their distribution in the universe are discussed, as well as diffuse X-ray and cosmic gamma radiation. Mechanisms of both X-ray and gamma radiation are presented. These include synchrotron radiation, Compton scattering, and bremsstrahlung. It is suggested that stable gamma radiation occurs simultaneously with X-radiation in discrete galactic sources of a nonthermal type. This explains the spatial distribution of gamma radiation and its intensity, if the X-ray spectrum extends into the region of gamma radiation.

Transl. by K.P.D.

N71-37446# Academy of Sciences (USSR), Moscow.
LOW ENERGY GAMMA RAYS (0.1-10 MeV) IN THE ATMOSPHERE AND IN SPACE c29
A. M. Romanov *In its* Proc. of the 6th Ann. All-Union Winter School of Space Phys., Part 1 1969 p 111-123 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

The formation of gamma rays in the interstellar medium and in stellar atmospheres is considered. Intensity calculations of galactic and metagalactic gamma rays, and of the intensity of gamma radiation of the quiet sun, are presented. The apparatus used for studying the spatial and spectral distribution of low energy gamma rays is described. This includes directional intensity detectors and measuring equipment. Atmospheric gamma ray properties, such as height and latitude dependence, albedo, and energy spectra, are noted. Results of experimental studies of low energy cosmic gamma rays include the diffuse background of Xray and gamma radiation, X-ray and gamma radiation of the Crab nebula, solar gamma rays, and gamma radiation from other discrete sources. The degree of anisotropy in diffuse (background) cosmic radiation was measured. Absolute magnitudes of cosmic gamma radiation from the sun and point objects, such as quasars and pulsars, were determined. The intensity of cosmic gamma radiation in spectral lines, and in the 0.51 MeV line in particular, and the degree of polarization of radiation from point objects, were also measured.

Transl. by K.P.D.

N71-37447# Academy of Sciences (USSR), Moscow.
STUDY OF COSMIC X-RAYS AND GAMMA RADIATION BY ARTIFICIAL EARTH SATELLITES c29
M. M. Anisimov, L. S. Bratolubovs-Tsulukidze, N. L. Grigorov, L. F. Kalinkin, A. S. Melioranskiy et al *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 2 1969 p 124-131 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

Short wave cosmic electromagnetic radiation of wavelength less than or equal to 100 A (or quantum energies greater than 0.1 keV) were studied. Proportional counters especially sensitive to energy over an area of 1000 sq cm were used. Intensity from both local and background sources decreased strongly with increase in energy, and results were statistically valid after a certain limiting sounding time. The measuring apparatus is described. Results from data obtained during several satellite flights are compared. In the region from 10 keV to 1 GeV, the gamma spectrum intensity may be said to depend to a certain degree on energy with an index level of about 2.2.

Transl. by K.P.D.

N71-37448# Academy of Sciences (USSR), Moscow.
VARIATIONS IN THE ELECTRON COMPONENT OF COSMIC RAYS AT ENERGIES FROM 100 TO 1600 MeV AT HIGH ATMOSPHERIC ALTITUDES c29
A. M. Gelper and S. I. Luchkov *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 132-136 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

A scintillation counter was used to record gamma radiation during eight sounding flights. A high electron rate which increased with height was noted. At the maximum height of the measurements, intensity remained constant. The results indicate two intensity groups, one with normal distribution and one with increased distribution. Assuming that the electron spectrum has an exponential form, the spectrum index can be determined. Electron albedo altitude was also determined. It is not possible to use the albedo stream to explain directly the electron stream extrapolated to the limits of the atmosphere, even in the case of normal intensity. Therefore it is suggested that the albedo electron stream within the atmosphere returns completely to the atmosphere. The occurrence of significant variable electron streams entering the atmosphere may indicate the altitude of secondary gamma quanta recorded in the upper levels of the atmosphere. It is assumed that at great heights the intensity of the secondary gamma quanta, as well as of nuclear interactions of primary cosmic rays, is determined by albedo electrons and electrons from the region of captured radiation. Then the complementary maximum intensity can be inferred to be about 30 g/sq cm of the residual atmosphere. A significant variation in the stream of entering electrons will cause variation in the amplitude of the complementary maximum. Transl. by K.P.D.

N71-37449# Academy of Sciences (USSR), Moscow.
SOLAR NEUTRINO EMISSION c29
G. Ye. Kocharov *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 137-152 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

The chemical composition of the primordial homogeneous sun and its age are discussed. The nonsphericity of the solar surface, its rotation, and solar neutrino streams are considered. New values of nuclear parameters, and hydrogen, helium, and heavy element concentrations for the solar surface were used to determine the rate of the reaction Cl-37(neutrino,electron)A-37. The oscillation hypothesis states that transfer occurs in the vacuum between different neutrino structures. This hypothesis is based on the suppositions that there exist in nature only four neutrino structures and that lepton charge is incompletely preserved. The oscillation theory indicates a decrease in the gravitational constant with time by a factor of two or more. A variation in solar neutrino intensity is also indicated. Suppositions concerning time properties of solar energy sources explain variations in the time rate of release of energy and neutrino streams in the solar interior.

Transl. by K.P.D.

N71-37450# Academy of Sciences (USSR), Moscow.
DIFFERENTIAL ROTATION AND THE NONSPHERICITY OF THE SUN'S SURFACE c29
S. S. Mendrykin and Yu. N. Starbunov *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 153-159 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

Differential rotation and turbulence produce magnetic and other forces related tangentially. These are in turn related to nonpotential forces at the sun's surface which are caused by processes occurring in the solar interior. The correlation of the magnetic field to the magnitude of the nonsphericity of a surface of constant density is determined. Redistribution of angular velocity in a rotating star is calculated. The rate of meridional circulation is also determined.

Transl. by K.P.D.

N71-37451# Academy of Sciences (USSR), Moscow.
NEUTRINO EXPERIMENTS IN ACCELERATORS c29
V. S. Kaftanov *In its* Proc. of the 6th Ann. All-Union Winter

School on Space Phys., Part 1 1969 p 160-169 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

The history of global neutrino accelerators experiments is reviewed. The equipment used is described, as well as the major results achieved. Transl. by K.P.D.

N71-37452# Academy of Sciences (USSR), Moscow.
STRUCTURE OF INTERPLANETARY SPACE BASED ON OBSERVATIONS OF LOW ENERGY COSMIC RAYS, 1965 TO 1967 c29
S. N. Vernov, G. P. Luubimov, and N. V. Pereslegina *In its* Papers from the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 173-180 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

Sounding of interplanetary space indicates that there is a quasi-Archimedes spiral structure to interplanetary magnetic fields which leave the active regions of the sun and rotate with it. These fields are disturbed by shock waves from solar flares. The shock waves rapidly die out between the orbits of the Earth and Mars. Solar cosmic rays, distributed in spiral fields, undergo drift toward the west. Low energy cosmic rays are effectively transferred from flares to shock wave fronts. Transl. by K.P.D.

N71-37453# Academy of Sciences (USSR), Moscow.
DISTRIBUTION OF SOLAR PROTONS WITH AN ENERGY NEAR 1 MeV IN INTERPLANETARY SPACE c29
S. N. Vernov, Ye. V. Gorchakov, and G. A. Timofeyev *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 181-184 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

Proton flares of solar origin were recorded during interplanetary automatic stations flights and ground observations. The transport of protons generated by solar flares is discussed. Charged particles generated in the sun are distributed in an interplanetary field having two components, a regular solar field and an unordered discontinuous field. The interaction of a proton with a discontinuous magnetic field is determined by solving for the mean path between discontinuities and the mean scattering angle for a single discontinuity, delta. It is proposed that the mean free path and the mean scattering angle, and, consequently, the transport path, do not depend on the heliocentric interval. Proton motion between discontinuities depends on the preservation of the magnetic moment.
Transl. by K.P.D.

N71-37454# Academy of Sciences (USSR), Moscow.
STUDY OF PROTON STREAMS IN THE 1.5 - 50 M EV RANGE BY THE ZOND 4 AND ZOND 5 AUTOMATIC INTERPLANETARY STATIONS c29
M. M. Bredov, A. A. Kolchin, V. V. Lebedev, and G. P. Skrebtsov *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 185-187 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

Low energy cosmic ray activity was observed in order to study the structure of the interplanetary magnetic field and the mechanism of solar modulation. The apparatus used is described. Proton intensity and velocity data are presented.
Transl. by K.P.D.

N71-37455# Academy of Sciences (USSR), Moscow.
DYNAMIC ORIENTATION OF ATOMIC AND MOLECULAR SPINS AND A NEW METHOD OF DETECTING AN INTERPLANETARY MAGNETIC FIELD c29
D. A. Varshalovich *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 188-194 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

Structures are discussed with reference to astrophysical systems. Statistical and dynamic spin orientations are considered. The major process leading to particle spin orientation in the cosmic medium is resonance scattering of directed streams of nonpolarized radiation. Necessary conditions and the mechanism of optic orientation are presented. Orientations and probable transitions are described. Population of magnetic sublevels and a method of determining the direction of the magnetic field vector are also presented. Transl. by K.P.D.

N71-37456# Academy of Sciences (USSR), Moscow.
THE PROBLEM OF RADIATIVE TRANSFER IN SPACE PHYSICS c29
Yu. N. Gnedin and A. Z. Dolginov *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 195-204 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

Interaction of optical and corpuscular radiation with matter is significant in astrophysics. Transmission of galactic and solar cosmic rays through the interplanetary magnetic field was studied. Mechanisms of generating different plasma waves and their transmission through solar and interplanetary plasma are discussed. Solar radiation transmission through a planet's atmosphere was studied and models of such planetary atmospheres were constructed. The interaction of gases propagating in a vacuum and the physical processes occurring in coast atmosphere were also considered. The determination of the composition of planets and heavenly bodies and proton stream interaction with the earth's atmosphere are discussed.
Transl. by K.P.D.

N71-37457# Academy of Sciences (USSR), Moscow.
STUDY OF COSMIC PHENOMENA IN THE LABORATORY c11
I. M. Podgorny *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 205-211 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

Shock waves are considered in relation to the solar wind as a supersonic plasma stream and its interaction with objects in space and between regions of plasma travelling at different velocities. The difference between these shock waves and those propagating in the Earth's atmosphere is their mechanism of energy dispersion in directed stream motion. The apparatus for studying nonimpact shock waves is described. Problems of near-Earth space and the surface of Venus are presented in this context. Experiments for studying the interaction of the solar wind with a two-dimensional magnetic dipole were devised, in order to reproduce the basic phenomena which occur in the vicinity of the Earth's magnetosphere. Transl. by K.P.D.

N71-37458# Academy of Sciences (USSR), Moscow.
EFFECT OF CHARGED PARTICLE CAPTURE BY A MAGNETIC FIELD, WITH IONIZATION LOSS c24
D. Kh. Morozov *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 212-214 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

Equations for the capture of high energy protons are derived. The method can be used for particles with energies such that drift approximation is impractical. The calculation gives only a qualitative description of the effect, however it may be applied to more exact models. Transl. by K.P.D.

N71-37459# Academy of Sciences (USSR), Moscow.
THEORY OF PARTICLE ACCELERATION IN THE COSMIC PLASMA
M. Ye. Kats and A. K. Yukhimuk *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 215 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

Using a quasi-linear approximation, the spectral density of ionic-sonic vibrations in the interplanetary plasma was calculated. The integral intensity spectrum was determined for particles accelerated by these vibrations. Transl. by K.P.D.

N71-37480# Academy of Sciences (USSR), Moscow.
A MECHANISM FOR THE ACCELERATION OF SOLAR WIND PLASMA c29
M. V. Konyukov *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 216-217 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

An equation describing stationary, spherically symmetric plasma discharge was used for a two-fluid approximation. The total mass stream was obtained. Temperature in the solar corona and the level of occurrence in a nearly laminar flow system, selected on the basis of density distribution, were used to calculate the nondimensional parameters. Acceleration of solar wind plasma may provide not only the necessary plasma ion energy but also an explanation for the monotonic decrease in temperature with distance from the emission level and the occurrence of a nonimpact discharge regime. Transl. by K.P.D.

N71-37481# Academy of Sciences (USSR), Moscow.
QUASI-EQUILIBRIUM STRUCTURES OF IONIZED STELLAR AND PLANETARY ATMOSPHERES
V. M. Fedeyev *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 7 1969 p 218-223 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

Equations are derived for a plasma model. Interaction and reciprocity of atmospheric elements are considered. The choice of a theoretical model was determined by its simplicity in dealing with and preserving the basic properties of the objects studied.
Transl. by K.P.D.

N71-37482# Academy of Sciences (USSR), Moscow.
SOLAR RADIO WAVE OBSERVATIONS c29
I. M. Gordon *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 224-228 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

The theory of effective solar diameter was proposed after studies of absorption in the corona, i.e. of total electron concentration distribution and temperature. Signal reflection involves an extremely wide range of variation in effective diameter. This variability is in contradiction to the mean value stability of parameters of the quiet corona, where the reflected signal is believed to be formed. The higher the frequency transmitted, the deeper the signal penetrates into the corona. Signal damping increases with frequency, with a corresponding decrease in effective scattering diameter. Quasi-symmetric distribution of the reflected signal with respect to frequency displacement can be interpreted by assuming that there are both ascending and descending components of motion. Extremely high reflection exist up to three solar radii. During reflected signal formation, induction processes of electromagnetic waves interacting with different wave modes produced by a turbulent coronal plasma play a major role. Thus the occurrence of large effective diameters invariably coexists with an increase in the level of natural solar radio wave emission and intensity fluctuations. Transl. by K.P.D.

N71-37483# Academy of Sciences (USSR), Moscow.
PENETRATION OF AURORAL PARTICLES INTO THE EARTH'S ATMOSPHERE c13
L. L. Lazutin *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 229-240 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

Rocket sounding provided auroral data. Penetration is extremely sporadic in both time and space. There is a definite configuration, fixed by the sun-earth vector, for penetration zones, which does not change significantly with time or level of magnetic activity. In the midnight region the efflux of auroral particles, both hard and soft, occurs in a narrow (5-10 deg) belt, centered about 65 deg geomagnetic latitude. Near midday the zone splits, because soft electrons are emitted in a narrow band near 75 deg. Emission in the near-belt region is more stable temporally, and particle streams and their energy are less, than in the aurora zone. A minimum occurs in the afternoon sector in the average stream of electrons emitted. During the morning hours a special type of particle emission occurs, having Brownian absorption. At this time slow variations in the electron stream occur with periods of 300-500 sec, in an area 200-500 km in width and more than 1000 km in length. Rapid variations with periods of 5-30 sec are sometimes superimposed on the smooth variations in the electron streams. Microbursts are generally observed on the background of quiet emission. Transl. by K.P.D.

N71-37484# Academy of Sciences (USSR), Moscow.
MAGNETOSPHERIC ELECTRIC FIELDS AND THE ROTATION OF THE EARTH c29
S. Ye. Bryunelli *In* its Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 242-251 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

Rotation is associated with both a general electric field and general circulation. During the electric field's quiet phases, which occur in the neutral layer of the magnetosphere's tail, it is not connected to the earth and does not influence geophysical processes. The penetration of this field into the magnetosphere and its transport along force lines to the earth leads to a DP-2 perturbation. If particle occurs at this time, several features of the acting field change, and DP-2 variation becomes a DP-1 perturbation, i.e. a polar substorm. An ionospheric current system of such a type generally consists of three branches. Two of these are currents along a high conductivity channel, the third is a hall current in the region of maximum electric current. Currents along lines of force play a large role in the creation of a DP-1 perturbed magnetic field. Transl. by K.P.D.

N71-37485# Academy of Sciences (USSR), Moscow.
DEVELOPMENT OF MAGNETIC STORMS IN THE EARTH'S ATMOSPHERE c29
M. I. Pudovskin, S. I. Isayev, and Zaytseva *In* its Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 252-260 refs In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

Experimental and theoretical data indicate the physical nature of storm processes taking place in the magnetosphere. Formation of an electric field occurs. Drift of the auroral plasma in the intersecting electric and magnetic fields and adiabatic acceleration of drift particles occur. Part of the plasma is captured by the geomagnetic field and a band of DR-currents is created. Instability is produced in the auroral plasma leading to particle redistribution according to pitch angle and their emission into the upper atmosphere. Transl. by K.P.D.

N71-37486# Academy of Sciences (USSR), Moscow.
APPLICATIONS OF METHODS OF MEASURING SMALL AND TRACE QUANTITIES OF DIFFERENT ISOTOPES TO ASTROPHYSICAL STUDIES c24
V. O. Naydenov *In* its proc. of the 6th Ann. All-Union Inter School on Space Phys., Part 1 1969 p 261-267 refs In RUSSIAN (See N71-37428 23-30) Avail: NTIS

Origin of the solar system is discussed. The history of cosmic ray, meteorite, and cosmic dust studies is reviewed. Radioactive isotope measurement in connection with the spatial distribution of cosmic rays and modulation effects, as well as with the solar wind, are also mentioned. Applications are possible in the determination of the composition of galactic and solar cosmic rays, material accretion by the earth, and the earth's radiation belt. Transl. by K.P.D.

N71-37487# Academy of Sciences (USSR), Moscow.
PLASMA CONTAINMENT IN ADIABATIC TRAPS c25
B. B. Kadomtsev *In* its Proc. of the 6th Ann. All-Union Winter School of Space Phys. Part 1 1969 p 268 In RUSSIAN (See

N71-37428 23-30)
Avail: NTIS

An adiabatic invariant is preserved to an exponential degree, but under a very strong magnetic field, a more prolonged containment is observed. This may be a hint of permanent preservation of the adiabatic invariant in axiaymmetric traps. Kinetic instability is of special interest as a phenomenon of the maser effect of strengthening electromagnetic waves through inverse population of energy levels. Ionic and electron hot plasmas are discussed. Collective processes determine instabilities in plasma contained in adiabatic traps. These instabilities are significant in the formation of the earth's radiation belts.

Transl. by K.P.D.

N71-37468# Academy of Sciences (USSR), Moscow.
PROTON DISTRIBUTION IN AN EXTERNAL REGION IN THE VARIABLES MU, L c24
Yu. I. Gubar and V. P. Shabanskiy *In* its Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 269 In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

Comparison of transport theory with experimental data for particles captured at right angles to drift shells is more current after transformation to a space of adiabatic invariants. Under preservation of the magnetic moment, the radial profile of intensity does not depend on minimum mu within a determined significance interval. Radial transmission of equatorial streams for small mu agree with analogous calculations from Explorer 12 data for particles close to the equator. The proton distribution function in mu,L space was determined. Distribution for belt maximum differs from stationary distribution without loss or addition. Separability of distribution functions for equatorial particles follows from the exponentiality of the energy spectrum and mu preservation. Proton pressure with a given minimum magnetic moment for a maximum belt is weakly dependent on L.

Transl. by K.P.D.

N71-37469# Academy of Sciences (USSR), Moscow.
A SELF-MODEL OF FLOW IN A RAREFIELD PLASMA c25
M. A. Gintsburg *In* its Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 270-271 In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

Equations were calculated for self-model evolution of a spherical plasmoid, a cylindrical plasma pinch, and a planar plasma layer. It was concluded that if the observation point is fixed and the density variation n is observed from time t, then, in contrast to spreading, the neutral fluidity function n(t) is not monotonic and has a certain maximum. Plasma spreading is laminar. A characteristic velocity inversion effect is observed. After density and velocity impulses pass a given point, ion velocity at this point is directed internally toward the center and outward plasmoid spreading takes the place of the inward ion stream. During movement toward the center, the ions are accelerated. After transmission of the impulse, ion velocities do not converge toward an unperturbed value. The process of ion acceleration is irreversible. At the time when this spherical (cylindrical, planar) impulse spreads, its amplitude decreases.

Transl. by K.P.D.

N71-37470# Academy of Sciences (USSR), Moscow.
PARTICLE ACCELERATION IN A COSMIC PLASMA c25
M. A. Gintsburg *In* its Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 272 *ref* In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

A mechanism for particle acceleration by means of vortical electric fields of nonlinear waves is discussed. The role of particles caught in a potential well of relativistic electron waves is analyzed.

Transl. by K.P.D.

N71-37471# Academy of Sciences (USSR), Moscow.
A COMPARISON OF VARIATIONS IN ENERGETIC ELECTRONS AND ULTRALOW FREQUENCY RADIATION c24
A. B. Malyshev, P. M. Svidskiy, V. A. Burov, I. G. Kleymenova, and V. A. Troitskaya *In* its Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 273 In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

Observations were made of electron streams in the region of drift shells with L parameters from 3 to 5.5 and at heights from 220 to 1150 km. Electron energies greater than 0.2 MeV were recorded by scintillation counters and greater than 1.5 MeV by Geiger counters. Ultralow frequency (ULF) radiation was recorded at ground stations in the 0.6-10 kHz band. Significant variations in streams of energetic electrons were observed. Catastrophic, normal, and insignificant emission types were noted. Assuming that ULF waves are distributed along lines of force, the upper frequency limit in each L-shell was calculated. The upper limit in the spectrum distributed in the magnetosphere was determined by absorption at the top of the force line due to electron cyclotron resonance. Energetic electron emission is associated with the ULF radiation spectrum. As a result of the interaction of captured electrons and electromagnetic waves, electron distribution is altered with respect to pitch angle. Interaction with ULF radiation is an effective mechanism for drawing electrons out of the outer radiation belt.

Transl. by K.P.D.

N71-37472# Academy of Sciences (USSR), Moscow.
INFLUENCE OF NONUNIFORMITY IN SOLAR WIND VELOCITY ON THE STRUCTURE OF THE INTERPLANETARY FIELD c29
I. I. Alekseyev, A. P. Kropotkin, and A. R. Shister *In* its Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 274 In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

The structure of the magnetic field is considered with respect to the anisotropy of plasma flow from the sun. The influence of thermal and magnetic pressure gradients on the velocity field may be disregarded in the first approximation. Therefore the solution is independent of time. For a spherically nonsymmetric plasma stream, the problem is solved for kinematic transport of a magnetic field from a region near the sun into interplanetary space. The form of the force line was obtained from which the determination of the general Archimedes spiral was made, representing the characteristic loops of various sizes similar to those observed experimentally.

Transl. by K.P.D.

N71-37473# Academy of Sciences (USSR), Moscow.
INTERACTION OF ENERGETIC PARTICLES WITH THE NEUTRAL LAYER OF THE MAGNETOSPHERE TAIL c29
I. I. Alekseyev and A. P. Kropotkin *In* its Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 275 In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

The neutral layer was considered to be an infinitely thin boundary dividing two regions of a homogeneous field. On the sides of this planar boundary the tangential field was of opposite sign. Normal and horizontal components of the magnetic field are dependent on a particle's pitch angle and phases of its Larmor rotation. Multiple boundary crossings precede the through transmission of the particle and its reflection. Evolution of the pitch angle distribution intersecting the boundary and reflected from it, along with strong pitch angle scattering, was calculated. For cases of small alpha much less than 1, as in the magnetosphere tail, an approximation was made of the first adiabatic invariant. Particle number, for the same alpha, was uniquely determined for reflected particles and those crossing the boundary. The total number of boundary crossings depends on the total magnitude of particle crossings along the neutral layer plane at right angles to the magnetosphere. Thus the effects of particles leaving the magnetosphere along the neutral layer, and those of injection, can be determined.

Transl. by K.P.D.

N71-37474# Academy of Sciences (USSR), Moscow.
LOCALIZATION OF ACTIVITY REGIONS IN THE SUN WHICH ARE RESPONSIBLE FOR THE GENERATION OF A GEOEFFECTIVE AGENT c29
V. P. Nefedyev *In* its Proc. of the 6th Ann. All-Union Winter School of Space Phys., Part 1 1969 p 276 In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

The generation of an agent which causes a decrease in the intensity of cosmic rays occurs on the photospheric, chromospheric, and coronal levels. Thirteen active regions are defined, twelve of which were associated with a decrease in both amplitude and character of the cosmic rays. Transl. by K.P.D.

N71-37475# Academy of Sciences (USSR), Moscow.
POSSIBILITY OF UTILIZING ELECTRIC FIELDS IN SPACE FOR RADIATION PROTECTION FROM PROTONS AND ELECTRONS c24
T. Ye. Ryabova and K. A. Trukhanov *In* its Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 1 1969 p 277-278 In RUSSIAN (See N71-37428 23-30)
Avail: NTIS

A method is suggested for diverting charged particles from the surface of a spaceship by using a high voltage field. An electrostatic radiation protection system is highly efficient and weighs 10 times less than other systems. Transl. by K.P.D.

N71-37476# Naval Research Lab., Washington, D.C.
[OCEAN SURFACE SENSING, ATMOSPHERIC TRANSMISSION, AND SCIENTIFIC PROGRAM NOTES] Report of NRL Progress, Aug. 1971
Aug. 1971 43 p refs
Avail: NTIS

Remote sensing of ocean surface conditions by radar is studied by theoretical radar sea return models as well as by experimental determinations of some of the parameters of the radar return which can be related to ocean parameters. Radar detection of oil films on ocean surfaces and the sensing of surface winds by Doppler spectra are emphasized. Studies on the transmission of infrared radiation through the earth's atmosphere near 5 microns detail spectral regions of carbon monoxide and iodine laser transitions. Also included are brief reports on projects pertaining to: sea photo diffraction analysis; design of uniform random number generator; radiation effects on thick steel; radiation damage to pressure vessel surfaces; X-ray diffraction analyses on plastic deformations of metallic microstructures; thickness effects on fracture resistance of titanium alloy sheets; fracture toughness of aluminum alloy sheet; fracture safe design with titanium alloys; corrosion mechanisms in metals; development of neutron spectrometer with organic scintillators; elastic stiffness of single crystal lead; sea water effects on photographic film; optical waveguides and integrated optics technology; laser beam propagation through the atmosphere; target tracking algorithms for search radar; glass contamination by platinum; and the design of a digital autotracking antenna system. For individual titles, see N71-37477 through N71-37478.

N71-37477# Naval Research Lab., Washington, D.C. Wave Propagation Branch.
REMOTE SENSING OF OCEAN EFFECTS WITH RADAR c13
N. W. Guinard *In its* Ocean Surface Sensing, Atmospheric Transmission, and Sci. Program notes Aug. 1971 p 1-11 refs Presented at the AGARD Conf. on Propagation Limitations in Remote Sensing, Colorado Springs, 22 Jun. 1971 (See N71-37476 23-30)
Avail: NTIS

Radar techniques and trends available in ocean studies for the collection of data pertaining to research in the field of remote sensing are discussed. A review of theoretical models and their parametric relationships which offer promise in the design of sensors is presented. Two new techniques for remotely sensing wave spectra are developed and used to obtain an explanation for the wavelength dependence of the sea return in low wind fields. Synthetic aperture radar is also used in ocean applications. Oil spills, both accidental and programmed, are imaged and the absence of radar return from the oil-covered surface is related to the damping of capillary and short gravity waves by the surface film. Author

N71-37478# Naval Research Lab., Washington, D.C. Laser Physics Branch.
ATMOSPHERIC TRANSMISSION NEAR 5 MICRONS c13
M. R. Pablo and W. J. Graham *In its* Ocean Surface Sensing, Atmospheric Transmission, and Sci. Program Notes Aug. 1971 p 12-15 refs (See N71-37476 23-30)
Avail: NTIS

The discovery of lasers operating near 5 microns has renewed interest in using the 3- to 5-micron atmospheric window for propagation. Transmission in this region is governed principally by CO2 and H2O. Curves are generated relating attenuation to wavenumber at relative humidities of 90, 45, 22.5, 9, and 4.5 percent for a conservative CO2 concentration of 500 atmosphere-centimeters over a 12.8-kilometer path length. Data points are computed every 2.5 wavenumbers for nine 50-wavenumber regions encompassing transitions of the iodine, CO, and DF lasers. The results are expressed as attenuation in decibels per kilometer. Author

N71-37479# Academy of Sciences (USSR), Moscow. Inst. for Space Research.
PECULIARITIES OF mm AND cm RADIOWAVE PROPAGATION IN VENUS ATMOSPHERE
N. N. Kroupenio 1970 18 p refs In ENGLISH and RUSSIAN (RR-16) Avail: NTIS

The flights of the Venus probes Venera 4, Venera 5, and Venera 6 made possible the measurement of atmospheric chemical composition, temperature, and pressure at altitudes above 30 km. From these results, it was possible to calculate the conditions of propagation of millimeter and centimeter waves in the planetary atmosphere. A model of the Venus atmosphere was computed under the assumption of a near-adiabatic altitude variation of temperature, and the model with the best correlation with direct radio wave attenuation measurements was chosen as the representative one. ESRO

N71-37480# Academy of Sciences (USSR), Moscow. Inst. for Space Research.
LUNAR SURFACE LAYER DENSITY FROM DATA OF THE RADAR MEASUREMENTS ON SPACECRAFT
N. N. Kroupenio 1970 22 p refs In RUSSIAN and ENGLISH (D-17) Avail: NTIS

On most of the automatic lunar surface stations, as well as on a series of lunar artificial satellites radar experiments were carried out which made it possible to determine the scattering characteristics of the lunar surface for cm and mm waves. These data are used to determine the density of the surface layer, and a comparison is made with the data from Apollo 11 lunar soil samples. ESRO

N71-37481# Electro-Mechanical Research, Inc., Princeton, N.J. Photoelectric Div.
NEW CHARGED PARTICLE DETECTORS Final Report, 1 Jul. 1969 - 16 Apr. 1971
Victor J. Belenger 26 Mar. 1971 11 p
(Contract F19628-69-C-0286)
(AD-726656; AFCRL-71-0212; POA-1506) Avail: NTIS CSCL 18/4

The object of this program was to finalize design, manufacture and deliver 50 Model 649-128 New Charged Particle Detectors. These detectors are to be used in a satellite experiment to study the magnetospheric boundary regions of space which will be conducted by Space Physics Laboratory, AFCRL. Author (GRA)

N71-37482# Army Missile Command, Redstone Arsenal, Ala. Aeroballistics Directorate.
MOTION OF AN ACCELERATED BODY IN A MEDIUM WHERE THE RESISTANCE VARIES AS THE SQUARE OF THE VELOCITY
Richard E. Dickson 10 May 1971 29 p
(AD-726929; RD-TM-71-2) Avail: NTIS CSCL 16/2

The solutions to the Riccati differential equation of the motion of an accelerated body in a medium where the resistance varies as the square of the velocity are presented in a form suitable for computation by desk calculator. In addition, a simpler and faster approximate solution is derived from these equations. Both methods are useful for fast point mass trajectory simulation and slide rule approximation. Author (GRA)

N71-37483# Royal Greenwich Observatory, Herstmonceux (England).
OPTICAL POSITIONS OF RADIO SOURCES
C. A. Murray, R. H. Tucker, and E. D. Clements 1971 28 p refs *Its* Bull. No. 162
Avail: NTIS; Royal Greenwich Obs., Herstmonceux Castle, Hailsham, Sussex, Engl. £ 10s BIS $2.00

Optical positions, on the FK4 system, of sixteen radio sources are presented. These have been derived from observations made with the Cooke Transit Circle and plates taken with the 13-inch and 28-inch refractors, and at the prime focus of the Isaac Newton Telescope. The transit circle positions of reference stars are compared with positions taken from AGK3, and the errors associated with both sets of positions are discussed. Optical positions for all these sources have been published previously by several authors, those presented here are completely independent of all previous work in that they do not depend on any catalogue positions or proper motions of reference stars Author

N71-37484# Royal Greenwich Observatory, Herstmonceux (England).
A SPECTROSCOPIC SEARCH FOR SOUTHERN DELTA SCUTI STARS
D. H. P. Jones 1971 10 p refs *Its* Bull No. 163
Avail: NTIS; Roy. Greenwich Obs., Herstmonceux Castle, Hailsham, Sussex, Engl.: £ 0.20

The radial velocities of eight stars were intensively in search of short-period variation. Two variables were discovered. Their pulsational and other characteristics are compared with the acknowledged delta Scuti variables. Author

N71-37485# Royal Greenwich Observatory, Herstmonceux (England).
THE STATISTICS OF THE NEARBY STARS
Richard Woolley, Susan B. Pocock, Elizabeth A. Epps, and Rosalind Flinn 1971 27 p refs *Its* Bull. No. 166
Avail: NTIS; Royal Greenwich Obs., Herstmonceux Castle, Hailsham, Sussex, Engl.: £ 0.40

Data which list all the stars known or supposed from their trigonometric parallaxes to be within 25 parsecs of the sun together with data on their colors, motions and box orbit parameters are used to construct a relation between spectral type and absolute magnitude. The luminosity function is calculated and it is suggested that the data imply an uneven rate of star formation in the sense that the number of stars formed recently is greater than the average rate of star formation relating to stars now found close to the sun. The proportion of double stars in the catalogue is calculated; it is found that 25 percent of stars are visual doubles and that this percentage is practically independent of spectral type. On the other hand, the proportion of spectroscopic binaries does appear to vary significantly from 28 percent in A stars to about 10 percent for late type main-sequence stars. It is shown that both low eccentricity and low box angle are characteristics of young stars. Author

N71-37486* National Aeronautics and Space Administration, Washington, D.C.
CONSTANTS OF LUNAR PHYSICAL LIBRATION
A. A. Gorynya Sep. 1971 204 p refs Transl. into ENGLISH of the book "Postoyannyye Fizicheskoy Libratsii Luny" Kiev, Naukova Dumka, 1969
(NASA-TT-F-661) Avail: NTIS CSCL 03A

A thorough review of earlier observations of lunar physical libration is given along with a critique and evaluation of these observations. A method is described in great detail which has been employed in determining lunar physical libration. This is the position angles method. It is important because it is the first attempt to dispense with total reliance on the lunar limb zone in determining the parameters of lunar rotation. All the observational data are given in the text and a lengthy appendix. These values of the constants of lunar rotation must be considered preliminary since they were obtained for an initial value f sub 0 = 0.65. The observations are being reprocessed for an initial value f sub 0 = 0.60 and the results of this processing will be published. Author

N71-37487# Perth Observatory (Australia).
PHOTOGRAPHIC POSITIONS OF COMETS AND MINOR PLANETS OBSERVED DURING 1968 - 1970
1970 19 p *Its* Commun. No 2
Avail: NTIS

The positions were obtained from plates taken with the standard astrographic telescope of the Perth Observatory. Comets to a nominal magnitude of 14 were observed and an attempt was made to observe any comet accessible for observation. Long series of positions were made for the bright comets 1969 g and 1969 i. Only the brighter minor planets were observed until 1969, when it was decided to concentrate on the fainter minor planets in need of observation. Author

N71-37488# Defence Standards Labs., Maribyrnong (Australia).
[SCIENTIFIC AND TECHNOLOGICAL RESEARCH AND INSTRUMENTATION] Annual Report, 1969 - 1970
1971 62 p refs
Avail: NTIS

A summary of basic and applied research, calibration and standardization services, and analyses and tests performed in work directly and indirectly related to defense activities is reported. Specific areas of development included: explosives, corrosion research, surface coatings, organic materials research, chemical physics, photoconductors, atmospheric contamination, pharmacology and biochemistry, lasers and optics, fracture research, deformation research, machining research, solidification research, temperature research, fire research, and instrumentation and techniques. J.G.M.

N71-37489*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
THE MANNED SPACECRAFT CENTER GEMINI MICROMETEORITE COLLECTION EXPERIMENT
Robert E. Flaherty Washington Oct. 1971 20 p refs
(NASA-TM-X-2408; MSC-S-239) Avail: NTIS CSCL 03B

Two aluminized Plexiglas samples were flown on the Gemini 9 spacecraft June 3 to 6, 1966. The samples had a combined sampling area of 0.00141 square meter and were exposed to the space environment for 16 hours 47 minutes. One stainless sample, vapor coated with multilayers of aluminum to a thickness of 10 microns, was flown on the Gemini 12 spacecraft November 11 to 14, 1966. This sample had an area of 0.000706 square meter and was exposed for 6 hours 24 minutes. There was no evidence of extraterrestrial-particle impact on any of the surfaces. However, a wide variety of surface effects was encountered and recorded; these effects exemplify the problems encountered in micrometeorite particle collection experiments. Author

N71-37480*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PLANETARY ORBITS IN THE EINSTEIN UNIVERSE
Abolghassem Ghaffari Sep. 1971 9 p refs
(NASA-TM-X-65711; X-651-71-398) Avail: NTIS CSCL 03C

The planetary or test particle orbits in Einstein space-time were studied. After a discussion of the geometrical properties of the spherical space and its connection with the Einstein space-time, it is shown that the orbits in the Einstein space-time are the great circles of the spherical space, and are therefore periodics. It is also proved that the velocity of motion along the great circles is constant. Author

N71-37481 Ohio State Univ., Columbus.
TIME OPTIMAL CONTROL WITH A FUEL CONSTRAINT FOR LINEAR TIME-INVARIANT SECOND-ORDER PLANTS
Tso-hai Wu (Ph.D. Thesis) 1970 187 p
Avail: Univ. Microfilms Order No. 70-19379

A noniterative method is presented based on Pontryagin's minimum principle coupled with state space techniques to investigate the time-optimal control for second-order linear time-invariant plants whose performance measure will be minimization of the response time with the fuel constrained by an upper bound M. First, an augmented state variable representing the instantaneous value of the remaining fuel is introduced in order to apply the minimum principle. Second, the necessary conditions of this principle are used to define a two-point boundary-value problem which is in turn reduced to that of determining the switching points of the optimal control policy which drives the system from its initial state to the origin. Third, the equations for the optimal trajectories and the switching curves in state space are derived. Fourth, the domain of available fuel in which the system can be driven to the origin in finite time and the consumed fuel being equal to or less than M is defined. Finally, time-optimal control policies for the considered plant are investigated. Dissert. Abstr.

N71-37482 California Inst. of Tech., Pasadena.
THE DETERMINATION OF SMALL TIME DIFFERENCES IN THE FORMATION OF PLANETARY OBJECTS
Dimitri Anastassiou Papanastassiou (Ph.D. Thesis) 1970 123 p
Avail: Univ. Microfilms Order No. 70-18043

A solid source, single focusing, sector magnet mass spectrometer was developed with a programmable magnetic field analyser. Digital data are obtained during a completely automatic sequence and include the real time at which an intensity measurement is made. An on line computer analyses the data and returns the results to the operator throughout a run. The precision obtained in measuring isotopic ratios is increased by an order of magnitude over conventional similar instruments and is documented for the strontium isotopes. The Sr-87/Sr-86 ratio is measured to better than + or - 0.007% over the extended time of the experiments. Calcium rich achondritic meteorites having a total spread of 0.2% in Sr-87/Sr-86 were studied and appear to define an idential initial abundance of 0.698983 + or - 0.000032. Measurements on Apollo 11 lunar samples are presented and discussed. Dissert. Abstr.

N71-37483 Texas Univ., Austin.
PHOTON PROPAGATION IN A PERTURBED EINSTEIN DE SITTER UNIVERSE CONTAINING PARTIALLY IONIZED GAS
Paul Chapin White (Ph.D. Thesis) 1970 108 p
Avail: Univ. Microfilms Order No. 70-18310

Photon propagation is studied in a locally inhomogeneous cosmological model containing partially ionized gas. Starting from the Boltzmann equation, a detailed derivation of the general relativistic photon transport equation is presented. Some of the usual approximations used in the transport equation are discussed, and an approximate solution for the photon distribution function is constructed in the limit of small optical depth. After constructing a particular locally irregular cosmological model based on the density perturbations of a dust-filled Einstein-de Sitter universe, the approximate solution of the transport equation is used to investigate the effects of photon scattering on two cosmological observables. Dissert. Abstr.

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N71-37484*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
GUST PENETRATION LOADS AND ELASTIC VEHICLE RESPONSE FOR SATURN 5 LAUNCH VEHICLES Final Technical Report
Lars E. Ericsson, J. Peter Reding, and Rolf A. Guenther Jul. 1970 88 p refs
(Contract NAS8-21459)
(NASA-CR-119944; LMSC-N-3C-70-2) Avail: NTIS CSCL 22B

An analytic study was made of the gust penetration loads and associated elastic vehicle response of Saturn 5 launch vehicles penetrating sinusoidal gusts. It was found that the neglect of separated flow effects in existing theories gave highly unrealistic and often unconservative predictions of the gust penetration loads and elastic vehicle response. An analytic theory is presented that includes the effects of separated flow and associated convective time lag effects, and which accepts static experimental data as an input, thereby providing more realistic gust load predictions. The classical treatment of the high-frequency gust response, e.g., panel vibration, is found to be unrealistic, since it does not include or allow for the effects of large-scale vorticity and coupling between successive separated flow regions. Saturn 5 launch vehicles AS-505 through AS-508 were analyzed and found to be aeroelastically stable throughout atmospheric ascent, the only question being whether the predicted large amplitude elastic vehicle bending response to sinusoidal gusts would correspond to structural stresses of tolerable magnitude. Author

N71-37485*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
STUDY OF DAMAGE CONTROL SYSTEMS FOR SPACE STATION Final Report, 24 Jul. 1970 - 24 Oct. 1971
M. J. Scherb, E. S. Chambers, G. V. Colombo, D. C. Gadt, J. F. Hartse et al Oct. 1971 312 p refs
(Contract NAS1-10184)
(NASA-CR-111983) Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

Promising damage control systems for detecting and locating overboard and onboard leak and damage modes on space stations were identified. These included a nitrogen use rate monitor, pressure wall-mounted transducer array, seal leak detectors, mass spectrometer, gas chromatograph, and a portable leak detector. A hazard analysis, weight tradeoff analysis, and access and leak repair studies were conducted. It was concluded that damage control systems for Space Station are feasible and cost-effective. It is recommended that requirements for damage control systems be reflected in future phases of the Space Station program. Author

N71-37486*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
PAYLOAD EFFECTS ANALYSIS STUDY Final Report
30 Jun. 1971 730 p
(Contract NAS9-2158)
(NASA-CR-122642; LMSC-A890558) Avail: NTIS CSCL 22B

The impact of future space transportation vehicles, including the space shuttle and space tug, on the cost of design, development, and operation of unmanned satellites of the 1970

to 1990 period is determined. The baseline payload and parametric cost optimization are described, and the low-cost payload design and interfaces with space and ground systems are discussed. It is concluded that significant cost benefits accrue from payloads designed on the basis of reduced weight/volume constraints, modularization and reuse, and relaxed reliability requirements (shuttle only). Additional savings are possible with standardization of payload subsystems and standard spacecraft. N.E.N.

N71-37497*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FLEXIBLE SPACECRAFT CONTROL SYSTEM DESIGN PROCEDURES UTILIZING HYBRID COORDINATES
P. W. Likins, E. L. Marsh, and G. E. Fleischer 15 Sep. 1971 88 p refs
(Contract NAS7-100)
(NASA-CR-122918; JPL-TM-33-493) Avail: NTIS CSCL 22B

Procedures for the practical implementation of the hybrid coordinate methods of dynamic analysis of flexible spacecraft in application to vehicles of realistic complexity are briefly documented, with supporting examples. Author

N71-37498*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: STATIC AERODYNAMIC CHARACTERISTICS OF THE BOEING SPACE SHUTTLE BOOSTER CONFIGURATION AT MACH 0.10 TO 0.29
Jacque Houser Jul. 1971 193 p
(Contract NAS8-4016)
(NASA-CR-119964; DMS-DR-1079-Rev-A) Avail: NTIS CSCL 22B

Experimental aerodynamic investigations have been conducted in a low speed wind tunnel on space shuttle booster configuration. Tests were conducted on a 0.02992 scale model vehicle over an angle of attack range from -8 deg to +32 deg and from -10 deg to 10 deg sideslip at Mach numbers below 0.29. Tests variables included configuration buildup, elevator deflections of plus or minus 30 deg, flap 15 deg and 40 deg, and stabilizer deflections of +10 deg and -20 deg. Author

N71-37499*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: GENERAL DYNAMICS/CONVAIR SPACE SHUTTLE BOOSTER. INVESTIGATION OF SUBSONIC STABILITY AND CONTROL EFFECTIVENESS
W. Zombek Nov. 1970 548 p
(Contract NAS8-4016)
(NASA-CR-119963; DMS-DR-1030) Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

Wind tunnel models of a straight wing configuration and delta wing configuration space shuttle booster were tested in a low space wind tunnel to determine the subsonic stability and control effectiveness. The tests were conducted over a range of dynamic pressures from 50 to 150 pounds per square foot, Mach numbers from 0.184 to 0.318, and Reynolds numbers from 1.24 times one million to 2.15 times one million per foot. Parameters investigated included wing position, boattail shape, control effectiveness, flap effectiveness, spoiler effectiveness, engine nacelle effect, and comparison of the delta wing and conventional wing. Author

N71-37500*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: STATIC STABILITY AND CONTROL INVESTIGATION FOR THE NORTH AMERICAN ROCKWELL DELTA WING (143B) AND STRAIGHT WING (130G) SPACE SHUTTLE ORBITERS Data Report
E. C. Allen and D. C. Olsen Oct. 1970 410 p
(Contract NAS8-4016)
(NASA-CR-119962; DMS-DR-1027) Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

Scale models of delta wing and straight wing space shuttle orbiters were tested in a 14 inch trisonic wind tunnel. The test was conducted as a static stability and control investigation over a Mach range of 0.60 to 5.00. The straight wing orbiter was tested in the body alone, body-wing, body-wing-horizontal stabilizer, and body-wing-horizontal stabilizer-vertical stabilizer configurations. The delta wing orbiter was tested in the body alone, body-wing (clipped tip), body-wing (complete delta wing), and body-wing vertical stabilizer configurations. The models were pitched over an angle of attack range of 0 deg to 60 deg at a fixed sideslip angle of 0 deg, and also yawed over an angle of sideslip range of -4 deg to 10 deg at fixed angles of attack of 0 deg, 10 deg, 15 deg, 30 deg, 45 deg, and 60 deg. Author

N71-37501*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: STUDY TO DEVELOP A SOLUTION FOR CONFIGURATION INSTABILITY FOR THE 0.003368 SCALE S-1C/NR HCR ORBITER
L. Watts (Boeing Co., Huntsville, Ala.) May 1971 485 p
(Contract NAS8-4016)
(NASA-CR-119966; DMS-DR-1091) Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

Experimental aerodynamic investigations were conducted in a trisonic wind tunnel on a scale model of a space shuttle orbiter mated to a S-1C booster. Six component static stability force data were recorded over a Mach number range from 0.60 to 2.0 at angles of attack from -8 deg to +8 deg at zero deg sideslip and from -2 deg to +8 deg sideslip angle at zero deg angle of attack. Test Reynolds number varied from 6.9 times 6 to 8.5 one million 6 per unit length. Primary test emphasis was on determining the aerodynamic effects of several size spoilers and vortex generators. Author

N71-37502*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: DETERMINATION OF STATIC AERODYNAMIC CHARACTERISTICS FOR THE NORTH AMERICAN ROCKWELL DELTA WING ORBITER AT MACH NUMBERS OF 0.4 TO 1.3
C. Donald Andrews and E. C. Allen Jun. 1971 239 p
(Contract NAS8-4016)
(NASA-CR-119967; DMS-DR-1092) Avail: NTIS CSCL 22B

A scale model of the delta wing orbiter was tested in a four-foot transonic wind tunnel to obtain force and static stability data at high angles of attack under essentially blockage free conditions. The model was tested at Mach Numbers of 0.4 to 1.3, elevon deflections of 0, minus 10, and minus 30 deg, and angle-of-attack ranges of 0 to 20, 20 to 40, 40 to 60, and 60 to 70 deg. Author

N71-37503*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTS OF EXHAUST PRODUCTS FROM A BIPROPELLANT ATTITUDE CONTROL ENGINE ON TRANSMITTANCE OF QUARTZ
Ernie W. Spisz, Robert L. Bowman, J. Perry Campbell, and John E. Cassidy Washington Sep. 1971 12 p refs
(NASA-TM-X-2399; E-6444) Avail: NTIS CSCL 22B

Preliminary results are presented on the effects of deposits from the exhaust products from a 22.5-newton thrust, engine on the transmittance of four quartz samples. Transmittance measurements were obtained with an ultraviolet spectrometer over the wavelength range from 0.2 to 0.6 micrometer and from 0.32 to 2.2 micrometers with an integrating sphere, lithium fluoride prism monochromator. The changes in transmittance of the four samples were quite significant and were due to both scattering and absorption effects. Scattering was found to be the primary degradation mechanism in the visible and near ultraviolet wavelength range; absorption was the predominant effect in the ultraviolet wavelength range. Author

N71-37504# Hawker Siddeley Dynamics, Ltd., Hatfield (England).
DESIGN REPORT TO ESRO FOR A DESPIN ASSEMBLY
J. Rees Paris ESRO Jan. 1971 132 p refs Sponsored by ESRO

(Contract ESTEC-942-70-AA)
(ESRO-CR-30) Avail: NTIS

A design for a spacecraft despin mechanism suitable for a despin platform configuration is developed. The object of the study was the creation of a complete design, with slip rings, to meet the given specification. Weight and reliability estimates are given, together with analyses of lubrication system, stress, motor control and slip-ring assembly. A complete set of working drawings is available, and a cost estimate for the construction of one unit is given. Author (ESRO)

N71-37505# European Space Research and Technology Center, Noordwijk (Netherlands).
THE EFFECT OF SHADOWS AND EARTH ALBEDO ON THE PERFORMANCE IN ORBIT OF THE ESRO-1B SOLAR ARRAY
A. Atzei Paris ESRO Apr. 1970 38 p refs
(ESRO-TN-103-ESTEC) Avail: NTIS

The solar array output of the ESRO-1B satellite in orbit was analyzed. The telemetered data were normalized to the standard conditions of temperature and illumination, and the results were interpreted, variation in the satellite's view factor being taken into account. The nominal I/V characteristic of the solar array was used as reference in view of ESRO-1B's short lifetime. The solar array performed satisfactorily. The influence of earth albedo and boom shadow was evaluated. The power output due to earth albedo was often as much as 25%, while the boom shadows led in some instances to power reductions of 15 to 20%. Author (ESRO)

N71-37506# Communications Satellite Corp., Washington, D.C.
PROPOSED REGIONAL SATELLITE SYSTEMS: WILL THEY BE COMPATIBLE WITH INTELSAT?
Richard R. Colino Paris EUROSPACE 1970 12 p Presented at the 4th EUROSPACE US-European Conf., Venice, 22-25 Sep. 1970
Avail: NTIS

The needs for compatibility of the European regional communication satellite with Intelsat system are emphasized.
ESRO

N71-37507# Academy of Sciences (USSR), Moscow. Inst. for Space Research.
ON A METHOD OF CONSTRUCTION OF ROVING VEHICLE CONTROL SYSTEM
B. L. Kozlov, L. N. Lupitchev, E. N. Orel, Y. K. Hodarev, and I. V. Shamanov 1970 15 p
(D-48) Avail: NTIS

In automatic acquisition systems for lunar surface relief data using stereoscopic sensors, the establishment of mutual correspondence of image points in the sterocouple is one of the major difficulties. A solution is proposed by which use is made of the technique of internal illumination. A realization with light scanning is described. ESRO

N71-37508# European Space Research and Technology Center, Noordwijk (Netherlands).
SPIN RESONANCE AND PASSIVE SPIN CONTROL OF MAGNETICALLY STABILISED SATELLITES. PART 1: THE DYNAMIC MODEL AND ITS APPROXIMATION
R. Kammueller Paris ESRO Mar. 1970 61 p refs
(ESRO-TR-5-ESTEC) Avail: NTIS

The equations of motion are derived, using Lagrange's approach. Since the spin motions considered here are extremely slow, the given dynamic system can be considered as being loosely coupled. Criteria are derived that enable the degree of coupling to be judged on as rigorous a basis as that developed for the limitation of nonlinear perturbing terms. A perturbation scheme has been prepared, which takes advantage of the smallness of the coupling terms in cases of loose coupling; these terms are regarded as perturbations to the residual system. Pitch and yaw motions now appear as known time-dependant variables in the differential equation for the spin motion. Finally, the normalised spin equations for the purely oscillatory case and for the case of persistent spin are set up. The spin equations are nonlinear second order differential equations with periodic coefficients; they do not permit closed analytical solutions.
Author (ESRO)

N71-37509# European Space Research and Technology Center, Noordwijk (Netherlands).
EUROPEAN SOUNDING-ROCKET CATALOGUE, VOLUME 1
Y. Guerin and R. Mory, comps. Paris ESRO Jun. 1970 148 p In FRENCH and ENGLISH
(ESRO-SP-39-ESTEC-Vol-1) Avail: NTIS

This catalog of sounding rockets is not intended to contain a detailed study of each vehicle, but rather to summarize in standard format information relating to current and future European vehicles. It also contains graphs permitting a quick comparative assessment of the basic characteristics and performances of the vehicles which are now available or being developed. The document was compiled from answers made in reply to a questionnaire sent to European manufacturers involved in the development or manufacture of such vehicles. A sounding rocket was considered as European when built by one or more of the ten member states of ESRO (Belgium, Denmark, Federal Republic of Germany, France, Italy, The Netherlands, Spain, Sweden, Switzerland, United Kingdom). Author (ESRO)

N71-37510# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
MEASUREMENT OF THE VISIBLE REFLECTANCE SPECTRA OF ORBITING SATELLITES
John V. Lambert (M.S. Thesis) Mar. 1971 74 p refs
(AD-726988; GEP/PH/71-11) Avail: NTIS CSCL 17/8

Low resolution reflectance spectra of three orbiting satellites, objects 2253, 3819, and 4392, were measured using a scanning spectrometer designed and built for use with the Aerospace Research Laboratories satellite tracking telescope. The spectrometer, having a variable bandpass interference filter as the dispersive element, operates between 4000 and 7000 A with a resolution of 150 A. The required data reduction procedures were developed and the system was tested on astronomical objects. The measured reflectance spectrum of object 2253 is in agreement with that of the known surface material, aluminum. The measured reflectance spectra of objects 3819 and 4392 resemble those of white paints. Author (GRA)

N71-37511# Lockheed Missiles and Space Co., Palo Alto, Calif.
SOME QUESTIONS OF SPACE VEHICLE ROLL CONTROL DURING ATMOSPHERIC REENTRY
B. N. Petrov [1971] 8 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 9, no. 3, 1971 p 323-330
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The angular motion of a space vehicle during atmospheric reentry is investigated considering the structure of the control system. An analysis is presented of the interconnected side motion (heading and role channels) and the mechanical substance of the stabilizing effect. The space vehicle heading motion is explained by means of a roll regulator. Author

N71-37512# Lockheed Missiles and Space Co., Palo Alto, Calif.
DETERMINATION OF THE ANGULAR LOCATION OF UNORIENTED ARTIFICAL EARTH SATELLITES FROM MAGNETOMETRIC MEASUREMENT RESULTS
A. M. Titov et al [1971] 13 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 9, no. 3, 1971 p 397-407
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A method is expounded for determining the angular location for a broad class of unoriented artificial earth satellites whose angular velocities exceed 0.5 deg/sec by means of magnetomet-

ric measurement data. The method is based on a harmonic analysis of the information and on application of the method of least squares. Conditions for the uniqueness of determining the satellite orientation in space are investigated. Results of processing magnetometric information on individual portions of the Cosmos-135 and Cosmos-196 flights are presented. Author

N71-37513# Auburn Univ., Ala. Dept. of Mechanical Engineering.
EFFECTS OF SYNERGISTIC ENVIRONMENTS ON HYPERSONIC INTERCEPTORS AND RE-ENTRY VEHICLES
Final Report, 15 Mar. - 15 May 1971
Joel M. Elliott, Reginald I. Vachon, David F. Dyer, Jerry R. Dunn, and Dahanra Y. Goswami May 1971 87 p refs
(Contract DAAH01-69-C-1818)
(AD-726957) Avail: NTIS CSCL 16/2

The report summarizes efforts to predict synergistic environment effects on interceptors. A technical summary is presented that discusses the boundary layer analysis programs, the thermal radiation analysis, the shock/inviscid flow analysis, blast encounter analysis and mass injection analysis programs. Programming instructions and a sample problem are contained in the report. Author (GRA)

N71-37514*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SOME FLIGHT INDUCED ENVIRONMENTAL DATA OBTAINED FROM TWO SIDEWINDER-ARCAS SOUNDING-ROCKET LAUNCHES
James C. Manning Washington Oct. 1971 39 p ref
(NASA-TM-X-2368; L-7869) Avail: NTIS CSCL 16A

Some flight-induced environmental data from two Sidewinder-Arcas sounding rockets launched at the White Sands Missile Range are presented. The data obtained were acceleration, structural vibration, internal temperature, heating rate, and roll rate. The measured flight structural data indicate that the vibrations occurring after the rocket ignition shock have amplitudes less than 1.5g along the longitudinal axis and less than 0.6g along the normal axis and that the maximum quasi-static acceleration is about 32g along the longitudinal axis (1g = 9.8 m/sq. sec). The measured thermal data indicate that the maximum payload internal temperature is 44.4 C (112 F) and the maximum heat rate is 38 KW/sq. m. (3.35 Btu/sq ft-sec). The second stage reached a maximum roll rate of 4.3 cps at second-stage burnout. Author

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N71-37515*# Techtran Corp., Glen Burnie, Md.
PERFORMANCE AND EVALUATION OF FATIGUE TESTS UNDER STATISTICAL LOAD, PART 1 [DURCHFUEHRUNG UND AUSWERTUNG VON DAUERFESTIGKEITS-VERSUCHEN BEI STATISTISCHER BEANSPRUCHUNG, TEIL 1]
W. Eller et al Washington NASA Oct. 1971 12 p refs
Transl. into ENGLISH from Maschinenbautechnik (East Germany), v. 2, no. 2, 1962 p 590-593
(Contract NASw-2037)
(NASA-TT-F-13976) Avail: NTIS CSCL 20K

Fatigue curves for parts subjected to statistical excitation are obtained directly through the use of laboratory tests on test bodies. In the calculations, it is assumed that the momentary values of the disturbance variables have a normal distribution. Author

N71-37516*# Transportation Systems Center, Cambridge, Mass.
EVALUATION OF NONDESTRUCTIVE TENSILE TESTING
Samuel M. Polcari and J. J. Bowe Jun. 1971 50 p
(NASA Order W-13256)
(NASA-CR-122643; DOT-TSC-NASA-71-10) Avail: NTIS CSCL 20K

The results of a series of experiments performed in the evaluation of nondestructive tensile testing of chip and wire bonds are reported. Semiconductor devices were subjected to time-temperature excursions, static-load life testing, and multiple pre-stressing loads to determine the feasibility of a nondestructive tensile testing approach. The importance of the breaking angle in determining the ultimate tensile strength of a wire bond, a factor not generally recognized nor implemented in such determinations, is emphasized. Author

N71-37517*# Translation Consultants, Ltd., Arlington, Va.
PRINCIPLES FOR THE EXECUTION OF TENSILE AND CREEP TESTS IN VACUUM AT HIGH TEMPERATURES [GESICHTSPUNKTE FUER DIE DIRCHFUEHRUNG VON ZUG- UND KRIECHVERSUCHEN IM VAKUUM BY HOHEN TEMPERATUREN]
F. Bollenrath et al Washington NASA Oct. 1971 21 p refs
Transl. into ENGLISH from the publ. "High Temperature Materials" Reutte/ Tyrol, Austria, Metallwerke Plansee, AG, 1969 p 998-1015
(Contract NASw-2038)
(NASA-TT-F-13939) Avail: NTIS CSCL 20K

The research conditions of vacuum, power initiation, expansion measurements, expansion rate, temperature, and temperature distribution were studied. For evaluation of the measurement methods, test norms, and materials and for the measurement of constituents it is necessary to know how reliable the resistance characteristics are. The relative resulting stress error is given as a function of the affecting parameters and dimensionless error moduli. Properties determined in tensile and creep studies of various work materials are reported. Author

N71-37518# Aeronautical Research Labs., Melbourne (Australia).
LATERAL INSTABILITY OF BEAMS OF RECTANGULAR CROSS-SECTION IN THE PLASTIC RANGE
J. Solvey and Beryl Green Nov. 1970 19 p refs
(ARL/SM-note-354) Avail: NTIS

Numerical values of lateral buckling coefficients for beams bent in the plastic range are presented as curves plotted against a nondimensional parameter. Author

N71-37519# Ohio State Univ., Columbus.
VIBRATION AND STABILITY OF BEAMS AND PLATES IN THE PRESENCE OF ELECTROMAGNETIC FIELDS
Suryanarayana Srinivasan (Ph.D. Thesis) 1970 263 p refs
Avail: NTIS

The development of an approximate theory to predict the low frequency standing wave characteristics and the stability parameters of elastic bodies in the presence of electromagnetic fields is discussed. Problems on vibration and stability of magnetoelastic beams and plates in the presence of axial and transverse magnetic fields are examined. The operation of experimental facilities for the generation of uniform magnetic fields and for the excitation, monitoring, and measurement of vibration is described. Author

N71-37520# California Univ., Berkeley. Lawrence Radiation Lab.
SUPERPOSITION MODEL FOR ENVIRONMENTALLY-ASSISTED FATIGUE-CRACK PROPAGATION
W. W. Gerberich, J. P. Sirat, and V. F. Zackay Mar. 1971 44 p refs Presented at the Intern. Conf. on Corrosion Fatigue, Storrs, Conn., 14 Jun. 1971
(Contract W-7405-eng-48)

(UCRL-20638; Conf-710603-1) Avail: NTIS

An analytical superposition model, which describes fatigue and stress corrosion cracking (SCC) components as independent processes, is derived for corrosion fatigue of high strength aluminum and steel alloys. In describing the SCC component, it was desirable to invoke a new parameter, which is the threshold stress intensity for environmentally-assisted fatigue crack propagation. In part, this explains how the relative contributions of SCC and fatigue components might change with stress intensity range and ratio of maximum to minimum stress intensity. Experimental data from both aluminum and steel alloys indicate that hydrogen diffusion models can be utilized as the thermally activated mechanisms of the SCC components. For example, the activation energy for corrosion fatigue crack propagation in a high strength metastable austenitic steel was found to be 8500 cal/mol. As long as the SCC mechanism was independent of the stress state (e.g. there may be a fracture morphology change due to a plane strain to plane stress transition), the proposed model could describe the corrosion fatigue rates within a factor of two. Author

N71-37521# Bendix Corp., Kansas City, Mo.
DESIGN EVALUATION OF INSULATOR PIN
R. D. Lohr Mar. 1971 43 p
(Contract AT(29-1)-613)
(BDX-613-294) Avail: NTIS

The ability of a metal and plastic switching pin to withstand an operational shock in excess of one million g's was significantly improved through configuration change and change of the insulating material from nylon to polycarbonate. Extensive tests were performed to determine the magnitude of shock imparted to the pin by an explosive motor. The evaluation of a number of material/configuration combinations to select the most suitable option is summarized. Author

N71-37522# Oak Ridge National Lab., Tenn.
ANALYSIS OF TORISPHERICAL SHELLS SUBJECTED TO CONCENTRATED LOADS
Richard C. Gwaltney (Ph.D. Thesis - Tenn. Univ., Knoxville) May 1971 82 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3201) Avail: NTIS

Analyses were derived to determine stresses in a torispherical shell which is attached to a cylindrical shell and which has a radial nozzle attached at its apex. The loadings considered were internal pressure, axial thrust applied to the nozzle, and a bending moment applied to the nozzle. A particular solution was developed for the bending analysis which had no limitation such as those placed on the earlier approximate solutions. Comparisons between the developed analyses and experimental data from two models tested under internal pressure show excellent agreement. The buckling of torispherical shells under internal pressure was studied by comparisons between calculated results and results from an experimental model that buckled. This study indicated that the structure failed by plastic collapse since the maximum stress was very close to the yield stress of the model material. Author

N71-37523# Aeronautical Research Labs., Melbourne (Australia).
A GENERALISATION OF MATRIX FORCE METHODS
D. G. Ford Jan. 1971 25 p refs
(ARL/SM-note-361) Avail: NTIS

The standard cutout-modification procedure in matrix force analysis was generalized to allow the elimination of loads other than those which naturally describe the state of stress in the elements. In this way general thin cracks may be represented by refinement of elements instead of by merely increasing their number. A further generalization also allows for modification of members which are cut. However, when this was used in an example to restrict stress patterns to those which seemed more reasonable, the general results were not improved and it was concluded that the straightforward approach was also the most accurate investigated. Author

N71-37524# Aeronautical Research Labs., Melbourne (Australia).
A SURVEY OF FATIGUE LIFE VARIABILITY IN ALUMINUM ALLOY AIRCRAFT STRUCTURES
G. S. Jost and F. E. Verinder Feb. 1971 25 p refs
(ARL/SM-report-329) Avail: NTIS

The variability, or scatter, in the fatigue lives of aluminium alloy aircraft structures was tested under both symmetric and asymmetric variable amplitude loading spectra and programmed and random loading sequences. Physically and statistically compatible data have been pooled to increase the precision of scatter estimates and this has clarified the influence of loading conditions on scatter. It has been found that, although loading sequence is of little importance, the symmetry of the loading spectrum has a major influence on scatter. Author

N71-37525# Naval Research Lab., Washington, D.C.
THE INFLUENCE OF GEOMETRIC VARIABLES ON K SUB C VALUES FOR TWO THIN SHEET ALUMINUM ALLOYS
Anna M. Sullivan and Charles N. Freed 17 Jun. 1971 22 p refs
(AD-726884; NRL-7270) Avail: NTIS CSCL 11/6

Linear-elastic fracture mechanics (LEFM) provides an analytical framework to define the relationship between flaw size and stress level by the single parameter K. At instability for thin sheet, this parameter becomes K sub c, indicating the critical value for a situation of plane stress. To develop a standardized specimen and test procedures, a program was initiated to explore the variables associated with thin sheet fracture testing. GRA

N71-37526# Massachusetts Inst. of Tech., Cambridge. Dept. of Naval Architecture and Marine Engineering.
POST-BUCKLING BEHAVIOR OF STIFFENED PLATES WITH SMALL INITIAL CURVATURE UNDER COMBINED LOADS
Alaa Mansour Oct. 1970 91 p refs
(Contract N00014-67-A-0204-0031)
(AD-726455; Rept-70-18; MIT-DSR-71619) Avail: NTIS CSCL 20/11

The post-buckling behavior of a stiffened plate with small initial curvature is discussed in this paper. The stiffened plate is idealized by an equivalent orthotropic plate. The basic differential equations are derived and solved under two sets of boundary and loading conditions. Non-dimensional design curves giving the center deflection, critical load, effective breadth, and bending moment are presented for different values of the inplane load, lateral load, virtual aspect ratio, stiffeners characteristics and initial deflection. A computer program is also presented in order to obtain the results for values of the parameters not covered in the design curves. An example on the use of the design curves is given in which the results are compared under different boundary conditions and different initial deflections. Author (GRA)

N71-37527# Brown Univ., Providence, R.I. Div. of Engineering.
INCREMENTAL FINITE ELEMENT ANALYSIS OF LARGE ELASTIC DEFORMATION PROBLEMS
Georges A. Dupuis May 1971 37 p refs Presented at the Conf. on Computer-Aided Eng., Waterloo, Ontario
(Contract N00014-67-A-0191-0007)
(AD-726727; TR-8) Avail: NTIS CSCL 20/11

Incremental variational principles involving the rate of displacement are obtained in Lagrangian and Eulerian description. Both of them lead straightforwardly to finite element discretization, resulting in incremental matrix equations. The various acceptable generalizations of Hooke's law for large displacements and small strains are reviewed. We discuss the respective merits of the Lagrangian and Eulerian formulation as well as the value of the approximation based on an intuitive updating of the coordinates. An application is made to a generalized plane stress problem. Author (GRA)

N71-37628# North Carolina State Univ., Raleigh. Dept. of Mechanical and Aerospace Engineering.
DEVELOPMENT OF A FINITE ELEMENT MODEL FOR THE CLASS 5 FLEXTENSIONAL UNDERWATER TRANSDUCER SHELL
George Georgopoulos and Larry H. Royster Jul. 1971 23 p refs
(Contract Nonr-486(11))
(AD-726726; TR-20) Avail: NTIS CSCL 17/1

A Finite Element Model is developed for the Class 5 Flextensional Underwater Transducer Shell for various end boundary conditions. A doubly curved axisymmetric spherical shell element is utilized in order to predict the dynamic response of spherical shells. Novozhilov's Thin Shell Theory is applied and the element stiffness and mass matrices are derived. The spherical shell is represented as a finite number of spherical frustra, joined at nodal circles. The equation of motion is written for the free vibration problem. Author (GRA)

N71-37629# North Carolina State Univ., Raleigh. Dept. of Mechanical and Aerospace Engineering.
A FORTRAN PROGRAM FOR CALCULATING THE FREE VIBRATIONAL FREQUENCIES AND MODE SHAPES FOR A SMOOTH ARC OF ARBITRARY SHAPE AND VARYING CROSS-SECTION
James R. Rutledge and Larry H. Royster Jul. 1971 55 p refs
(Contract Nonr-986(11))
(AD-726725; TR-18) Avail: NTIS CSCL 20/11

The report describes a Fortran program to approximate the free vibration of a symmetric smooth arc of arbitrary shape with horizontally-guided boundary conditions and varying cross-section. Author (GRA)

N71-37630# North Carolina State Univ., Raleigh. Dept. of Mechanical and Aerospace Engineering.
AN APPROXIMATE MATHEMATICAL MODEL FOR THE FREE VIBRATIONS OF A SMOOTH ARC OF ARBITRARY SHAPE AND VARYING CROSS-SECTION
James R. Rutledge and Larry H. Royster Jul. 1971 24 p refs
(Contract Nonr-986(11))
(AD-726724; TR-17) Avail: NTIS CSCL 20/11

An approximate mathematical model for the free vibrations of a smooth arc of arbitrary shape and varying cross-sectional area is presented. The equations of motion for the interior points and three boundary conditions are developed in detail.
Author (GRA)

N71-37631# New South Wales Univ., Kensington (Australia). School of Civil Engineering.
ON A MIXED FORMULATION OF SAINT-VENANT TORSION PROBLEM OF NONHOMOGENEOUS ANISOTROPIC BARS
A. K. Noor and K. J. Robertson Apr. 1971 41 p refs
(R-65) Avail: NTIS

A variational derivation is presented of the governing differential equations of the mixed formulation for the Saint Venant torsion problem of nonhomogeneous anisotropic bars. The governing equations which consist of three first-order partial differential equations of the shear stresses and warping function have the features of possessing a symmetric coefficient matrix and being totally free of derivatives of elastic properties. The basic advantages of the mixed formulation over the commonly used stress and displacement formulations are discussed and a modified consistent finite-difference variant is presented for the solution of the governing differential equations. The accuracy of this finite-difference scheme is demonstrated by means of numerical examples. Author

N71-37632# Air Force Systems Command, Wright-Patterson AFB, Ohio. Materials Lab.
THE DEVELOPMENT AND USE OF A TORSIONAL SPLIT HOPKINSON BAR FOR EXPERIMENTS IN DYNAMIC PLASTICITY Summary Technical Report, Sep. 1969 - Dec. 1970
Theodore Nicholas and J. D. E. Campbell May 1971 39 p refs
(AD-726998; AFML-TR-71-32) Avail: NTIS CSCL 14/2

The development and use of a torsional split-Hopkinson bar testing apparatus for determining the mechanical properties of materials at high rates of strain is described. The apparatus is capable of generating a smooth torsional pulse with a rise-time of approximately 20 microseconds and can be used to generate shear stress-strain data at strain rates above 1000/sec. Experimental data are presented for an aluminum alloy. Results of incremental wave propagation tests on quasistatically prestressed specimens of an essentially RATE-INDEPENDENT metal indicate that the velocity of propagation of the wave front is that of an elastic shear wave which is in agreement with the rate-dependent theory of plastic wave propagation.
Author (GRA)

N71-37633# Columbia Univ., New York. Dept. of Civil Engineering and Engineering Mechanics.
ON THE POSSIBILITY OF OBSERVING NONLINEAR EFFECTS IN THE VIBRATIONS OF CYLINDRICAL SHELLS IN VACUO OR SUBMERGED
Hans H. Bleich Jun. 1971 22 p refs
(Contract N00014-67-A-0108-0029)
(AD-726765; TR-47) Avail: NTIS CSCL 13/13

An extensive nonlinear analysis in a preceding report is applied qualitatively to predict circumstances where 'unusual' responses in forced vibrations of shells, in vacuo or submerged, may be observable. It is concluded that due to unavoidable structural damping, unusual effects in vacuo will be unobservable except in lobar modes with large n, say n greater than 6, and for longitudinal nodal distances of L/R much greater than 1. Even in these cases the structures must be stressed to a considerable fraction, say 1/2, of yield. In submerged shells radiation damping is added to the structural one, reducing the observable range somewhat further. Except in marginal cases, the unusual effects should be observable in submerged cases whenever they can be found in vacuo. Author (GRA)

N71-37634# Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.
MEASUREMENT OF STRUCTURAL VIBRATIONS EXCITED BY RANDOM FORCE
Nobuharu Aoshima Jun. 1971 18 p refs *Its* Vol. 36, No. 8 (ISAS-466) Avail: NTIS

Structural vibrations excited by pressure loading which is random in space and time are considered. Power spectra of generalized force and generalized coordinate variables are discussed in general linear vibrating systems. Vibration magnitude of generalized coordinate variables and mode shapes are determined from simultaneous measurement of vibration quantities at many points by summing up the results with variable weightings. As an example, flexural vibration of thin beam, which is acted upon by pressure fluctuation of air flow or random sound pressure, is measured by strain gages and real time spectrum analyzer. Author

N71-37635*# Southern Illinois Univ., Carbondale. School of Technology.
ADVANCED STRUCTURAL GEOMETRY STUDIES. PART 1: POLYHEDRAL SUBDIVISION CONCEPTS FOR STRUCTURAL APPLICATIONS
Joseph D. Clinton Washington NASA Sep. 1971 206 p refs
(Grant NGR-14-008-002)
(NASA-CR-1734) Avail: NTIS CSCL 20K

A study leading to the formulation of computer-oriented mathematical models pertaining to methods of subdividing polyhedra into triangulated spherical space frames is presented. The models perform the truncations and transformations of the polyhedral forms and calculate the geometrical properties of the generated space frames (spheres, hemispheres, and domes).
Author

N71-37536# Case Western Reserve Univ., Cleveland, Ohio. Div. of Fluid Thermal and Aerospace Sciences.
AXISYMMETRIC VIBRATION OF AN ELASTIC SPHERICAL SHELL FILLED WITH A VISCOUS INCOMPRESSIBLE FLUID
Richard Paul Carroll and Simon Ostrach Jan. 1971 107 p refs (Grant AF-AFOSR-0184-67)
(AD-726834; FTAS/TR-70-55; AFOSR-70-2872TR) Avail: NTIS CSCL 20/11

The present analysis of a vibrating shell filled with fluid agrees with previous results in the limits of thin shells and zero viscosity, but extends those results to arbitrary shell thickness and viscosity, and obtains the complete frequency spectrum, without the truncation resulting from the assumptions of thin-shell theory. Allowance is made for an arbitrary spherically symmetric static stress distribution, and gravity is taken into account, in view of applications to planetary vibration. The solution is obtained for arbitrary Poisson ratio, and a boundary layer effect is demonstrated in the case of small viscosity. The effect of a fluid center upon lunar vibration is examined, as well as the importance of the hydrostatic assumption for the static stress field. The effect of viscosity is exhibited for a vibrating system comparable to the human eye. Author (GRA)

N71-37537*# Southern Illinois Univ., Carbondale. School of Technology.
ADVANCED STRUCTURAL GEOMETRY STUDIES. PART 2: A GEOMETRIC TRANSFORMATION CONCEPT FOR EXPANDING RIGID STRUCTURES
Joseph D. Clinton Washington NASA Sep. 1971 147 p refs (Grant NGR-14-008-002)
(NASA-CR-1735) Avail: NTIS CSCL 20K

A study concerned with a geometrical transformation concept for expanding Tesselation and Polyhedral forms applicable to expandable structures is presented. Structural systems capable of being packaged in a small compact area and later deployed into a final, larger structural system are described. Five basic concepts are considered: (1) telescoping concept, (2) folding concept, (3) fan concept, (4) umbrella concept, and (5) variable geometry concept. Author

N71-37538*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INVESTIGATION OF PACKAGING, DEPLOYMENT, AND LEAK-RATE CHARACTERISTICS OF AN INFLATABLE LUNAR-SHELTER MODEL
Clarence O. Keller Washington Oct. 1971 39 p refs
(NASA-TM-X-2393; L-7817) Avail: NTIS CSCL 13M

An investigation was conducted under ambient atmospheric conditions and in an 18.3-m-diameter vacuum chamber to determine the folding, packaging, deployment, and leak-rate characteristics of a large-scale lunar-shelter structures model. A folding and packaging procedure was developed from tests with a 0.10-scale model. It was found from these packaging tests that packaging factor was 6.5:1 which reduced the inflated volume from 14.58 cubic meters 3 to a packaged volume of 2.27 cubic meters 3. The internal gas leak rate obtained was less than 0.23 kg per day. The lunar-shelter module was successfully deployed in the vacuum environment at a vacuum pressure of 133.3 newtons per square meter. An examination of the module after the packaging, pressurization, and deployment tests revealed no appreciable damage to the composite wall structure. Author

N71-37539*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MEASUREMENTS AND ANALYSIS OF SOLID PROPELLANT ROCKET VIBRATIONS OBTAINED DURING A CAPTIVE FLIGHT
James A. Schoenster Washington NASA Oct. 1971 40 p refs
(NASA-TN-D-6517; L-7837) Avail: NTIS CSCL 20K

As part of an overall program to investigate the vibrational environment of small solid-propellant rockets, a captive test firing of a Nike rocket with a boilerplate payload was conducted in a unique test stand which, while restraining the total vehicle displacement, allowed substantial freedom for the test vehicle to vibrate. Measurements obtained of the vibratory accelerations, pressures in the rocket case, rocket-case strains, and total vehicle displacement data are presented. A discussion of the analytical procedures used to interpret random phenomena is presented. Author

N71-37540# Southampton Univ. (England). Inst. of Sound and Vibration Research.
THE REDUCTION OF RESONANT VIBRATIONS IN INTEGRALLY STIFFENED SKIN STRINGER PANELS USING VISCO-ELASTIC MATERIALS Final Report, 15 Feb. 1968 - 14 Feb. 1970
Fernando Cicci Wright-Patterson AFB, Ohio AFML 29 Oct. 1971 243 p refs
(Contract F61052-68-C-0027)
(AD-727773; AFML-TR-71-1) Avail: NTIS CSCL 01/3

The vibration characteristics of integrally stiffened skin-stringer panels have been investigated theoretically and experimentally. This type of structure was found to have mode shapes similar to those of flat plates due to the relatively low values of stringer bending stiffness. The experimental measurements were made by means of strain gauges and accelerometers, with the typical panel excited acoustically by travelling waves at approximately grazing incidence. Methods of damping the resonant vibrations were also investigated theoretically and experimentally. Predictions were verified using a beam taken from the cross section of an integrally stiffened panel. It was found that an extremely efficient method was one in which a damper was attached to the free edges of the stringers. This damper could be either a strip of viscoelastic material or a shear system made up of metal skins and a viscoelastic shear layer. Author (GRA)

N71-37541 Nebraska Univ., Lincoln.
DYNAMIC RESPONSE OF SLENDER CYLINDERS IN AXIAL FLUID FLOW WHEN SUBJECTED TO TIME VARYING BOUNDARY CONDITIONS
Stanley Alan Knudson (Ph.D. Thesis) 1970 114 p
Avail: Univ. Microfilms Order No. 70-17731

The dynamic response of a long slender circular cylinder in coaxial flowing fluid with base excited motion is investigated. The cylinder has a fixed-free configuration and the response behavior is analyzed by considering the resultant rms strain levels obtained with various flow velocities and levels of base excitation. The length of the tube was also varied to establish the effects of tube frequency and fluid flow velocity on the dynamic response characteristics. It is established that the fluid flow velocity acts as a damping mechanism and that the amount of damping increases with increasing fluid flow velocity. Within certain limits, a functional relationship is defined which shows the peak dynamic response to be a linear function of the base excitation level and a nonlinear function of the fluid flow velocity. Some trends are established which show certain response regions of predominance and bounds which depend upon the magnitude of the base excitation. Dissert. Abstr

N71-37542 Stanford Univ., Calif.
PLANE GRIDWORKS AND THE COSSERAT CONTINUUM
Robert Joe Wiley (Ph.D. Thesis) 1970 155 p
Avail: Univ. Microfilms Order No. 70-18506

The problem of couple stresses, moments distributed over an area of a continuous medium, is analyzed from a discrete approach. A two-dimensional Cosserat continuum is visualized as a plane gridwork consisting of flexible beams rigidly fastened at joints. As the mesh width becomes small, the gridwork behaves like a continuum. The limiting procedure requires special attention in order that the moment quantities do not vanish. These moments are the couple stresses of the limiting case. Two gridwork models are analyzed for the cases of edge loads and

distributed moment loads. It is shown that a microstructure is necessary for the existence of couple stresses. Terms of an order of magnitude higher than used in classical elasticity must be considered for the Cosserat continuum. Numerical examples indicate that a couple stress effect decays rapidly from the disturbance causing it. Dissert. Abstr.

N71-37543 Stanford Univ., Calif.
IMPACT ON PLATES ON ELASTIC FOUNDATIONS
Arthur Gates Ware, III (Ph.D. Thesis) 1970 104 p
Avail: Univ. Microfilms Order No. 70-18501

The equations of motion for a plate-foundation system under a dynamic load are presented. By assuming that the load can be broken into the product of a space-dependent function and a time-dependent function two approaches are followed to separate the basic partial differential equations for the infinite plate. The final solutions are applied to the landing of an aircraft and numerical examples are carried out to illustrate the effect of the various parameters. The results show that the responses of plates on elastic foundations are almost identical whenever the bending rigidity of the plate is greater than that of the model. However, for plates possessing less bending rigidity than the foundation, the continuity of the foundation begins to assert itself. The concluding part of the work describes the cases of dual and multiple wheel assemblies and possible extensions of the investigation are outlined. Dissert. Abstr.

N71-37544 Purdue Univ., Lafayette, Ind.
UNIAXIAL WAVE PROPAGATION IN NONLINEAR VISCOELASTIC MATERIALS
Joseph Paul Vogt (Ph.D. Thesis) 1970 160 p
Avail: Univ. Microfilms Order No. 70-18761

Isothermal wave propagation in semi-infinite rods is investigated for two types of nonlinear viscoelastic materials. For definiteness, only velocity boundary conditions are considered. The approach used in attempting to solve in closed form the wave propagation problems considered is to expand the particle velocity behind the wave front in a Taylor series about the front and to use appropriate compatibility, momentum, and constitutive equations, formulated with the aid of the theory of propagating surfaces of discontinuity, to find equations governing the unknown functions appearing in the series. In the various series used, only the unknown functions appearing in the first few terms of the series are solved for explicitly. Features such as shock formation and the stability of a wave front with respect to small disturbances are investigated, and the effect these features have on the validity of a series solution is mentioned. Necessary conditions for the convergence of a series to the exact solution are also considered. Dissert. Abstr.

N71-37545 Texas Univ., Austin.
NONLINEAR ANALYSIS OF PLANAR FRAMES
Bill Lee Gunnin (Ph.D. Thesis) 1970 220 p
Avail: Univ. Microfilms Order No. 70-18242

A computational technique is described for the generalized nonlinear analysis of planar rigid frames under static, short-time loading. The nonlinear moment-thrust-curvature relationship is reduced to a mathematical expression which can be made to represent common structural members. Applications for structural steel members and reinforced concrete members are emphasized. All large displacements of the joints are accommodated, including the P-Delta effect and axial shortening of the members. In order to demonstrate the applicability of the computational method to complex structures, a ten-story, three-bay reinforced concrete apartment building is studied. Limit loads are estimated for failure conditions under three load cases; with increasing wind load, increasing gravity live load, and proportionate wind and gravity live loads increasing simultaneously. Dissert. Abstr.

N71-37546 Texas Univ., Austin.
DYNAMIC ANALYSIS OF DISCRETE-ELEMENT PLATES ON NONLINEAR FOUNDATIONS
Allen Eugene Kelly (Ph.D. Thesis) 1970 205 p
Avail: Univ. Microfilms Order No. 70-18258

The method was programmed for a high speed digital computer and can be used for a wide variety of plate vibration problems. The assumption of a linear variation in acceleration during the time-step interval was utilized to develop a recursive solution procedure. Recommendations based on the stability analysis of the algorithm are presented for the selection of the time-step increment. The load iteration method is presented as an alternative to stiffness adjustment procedures. Dissert. Abstr.

N71-37547 California Univ., Berkeley.
MEMBRANE SHAPES FOR SHELL STRUCTURES
Peter Gordon Smith (Ph.D. Thesis) 1969 255 p
Avail: Univ. Microfilms Order No. 70-17660

A numerical formulation for the nonlinear theory of membrane shells is developed. The approach is applied to the determination of shapes for flexible membranes subjected to various loading conditions. The shapes obtained are used to design several civil engineering shell structures. The development is general and can be applied to the design of shells having arbitrary geometry, material properties, thickness and boundary conditions. The method is applied to the design of arches, roof structures, arch dams, storage tanks, and a tubular joint. Evaluation of the stresses in these structures indicates that the use of membrane shapes represents a rational approach to the design of a large class of shell structures. Dissert. Abstr.

N71-37548 California Univ., Berkeley.
FINITE ELEMENT ANALYSIS OF CELLULAR STRUCTURES
Kaspar Jodok William (Ph.D. Thesis) 1969 308 p
Avail: Univ. Microfilms Order No. 70-17686

A variation is introduced to derive the stiffness of different finite elements in order to increase the element flexibility obtained. A comparison of elements is made to test a series of quadrilateral plane stress elements by varying the geometry and material properties using different orders of numerical integration. The results were verified on the basis of realistic boundary value problems using different element assemblies. A variety of global nodal configurations are investigated. Two computer programs are developed using different elements to represent the behavior of individual structural components. Dissert. Abstr.

N71-37549 California Univ., Berkeley.
THE DYNAMIC PLASTIC BEHAVIOR OF STRUCTURAL ELEMENTS OF RATE SENSITIVE MATERIALS
Tamin Wahby El-Kasrawy (Ph.D. Thesis) 1969 90 p
Avail: Univ. Microfilms Order No. 70-17550

The different forms of the constitutive equations for the materials are discussed for one- and multi-dimensional problems. An equation based on the assumption that the viscoplastic strain rate is proportional to the excess stress above the yield surface was used. This equation was generalized for a beam element. A dynamic yield surface which changes with rate was established. A finite element approach was used to form the dynamic equilibrium equations of a general beam. The differential constitutive equation was transformed into an incremental one. The solution was carried out in a step by step numerical integration. A computer program was developed and problems involving cantilever beams were solved. Dissert. Abstr.

N71-37550 Pennsylvania State Univ., University Park.
TORSIONAL STIFFNESS OF COMPOSITE STRUCTURAL MEMBERS
William Warren Davidson (Ph.D. Thesis) 1969 183 p
Avail: Univ. Microfilms Order No. 70-19402

A method of analysis was developed, based on Prandtl's membrane analogy, which is readily adaptable to structural shapes in design. A number of composite members were tested, and the results were then compared with the analytical values. Three basic types of sections were considered: thin walled open,

thin walled closed, and solid. The method developed for thin walled closed sections is probably of more practical importance than the methods for open and solid sections. It is also applicable to multicellular members and members with laminated walls. The common assumption of constant shear flow in a thin walled closed section is only true for sections with two axes of symmetry. From test results it appears that prestressing does not appreciably affect torsional stiffness. Also, the transformed membrane analogy shows the presence of the tendons will probably not change the stiffness by more than a few per cent at most. Dissert. Abstr.

N71-37551 Stanford Univ., Calif.
TRIANGULAR FINITE ELEMENT FOR CYLINDRICAL SHELLS
Norman Allen Cyr (Ph.D. Thesis) 1970 212 p
Avail: Univ. Microfilms Order No. 70-18393

The stiffness matrix for a triangular cylindrical shell element is derived using thin shell theory and a cylindrical coordinate system, thereby laying a foundation for the development of a family of special-purpose triangular elements for the structural analysis of more complex shells such as cones, spheres, and paraboloids. The stiffness matrix is first derived using standard procedures based on the minimum potential energy principle. Lagrangian multiplier functions are employed to force a weighted average or best fit continuity of both displacements and normal slopes across interelement boundaries. Five sample problems were solved, and the solutions were found to compare favorably with solutions obtained by classical theory or other computer programs. Suggestions are made for the derivation of the stiffness matrix of a triangular element for the analysis of spherical shells. Displacement functions are given for this spherical element. Dissert. Abstr.

N71-37552 New York Univ., N.Y. School of Engineering and Science.
INELASTIC ANALYSIS OF THREE-DIMENSIONAL STIFFENED AND UNSTIFFENED SUSPENSION STRUCTURES
John J. Jonatowski (Ph.D. Thesis) 1969 124 p
Avail: Univ. Microfilms Order No. 70-19283

The procedure is an incremental load analysis which utilizes the displacement method and includes the effects of joint displacement and member axial force. With this numerical procedure the behavior of the structure may be studied as it is loaded from the initial condition to its ultimate carrying capacity. The flexural members comprising the stiffening system of suspension structures are initially straight, of wide flange cross section, and made from an elastic-perfectly plastic material free of residual thermal strains. A continuous smooth curve is utilized for the cable stress-strain relationship. The numerical procedure was programmed for the CDC 6600 electronic digital computer. This program was utilized for numerical studies of plane frames, space frameworks, isolated cables, three-dimensional cable networks, and planar, as well as three-dimensional, stiffened suspension structures. Dissert. Abstr.

N71-37553 Stanford Univ., Calif.
DYNAMIC STABILITY OF CYLINDRICAL SHELLS AND FOLDED PLATES SUBJECTED TO STOCHASTIC EXCITATIONS
Kennon Dwaine Vaudrey (Ph.D. Thesis) 1970 173 p
Avail: Univ. Microfilms Order No. 70-18497

A cylindrical shell with a stochastically applied axial excitation, a random external radial pressure, a folded plate with a random edge force, and a distributed stochastic lateral load is investigated. The stability in the sense of Liapunov is defined, and theorems of the direct method of Liapunov are given. The governing equations are determined by using small deflection theory and assuming that the structures behave elastically. The only restricting assumptions are that the input excitations be stationary processes and that the output state space vector be constrained to remain within some arbitrary preset bound, thereby, insuring physical stability of the structure. A brief discussion of nonlinear, nonautonomous, stochastic differential equations with an attempt to obtain a suitable Liapunov function for Van der Pol's equation having a random damping coefficient is presented. Dissert. Abstr.

N71-37554 California Univ., Berkeley.
A PHYSICAL-MATHEMATICAL MODEL FOR THE DEFORMATION AND FAILURE OF BRITTLE MATERIALS UNDER GENERAL STATES OF STRESS
Michael Anthony Taylor (Ph.D. Thesis) 1969 176 p
Avail: Univ. Microfilms Order No. 70-17670

A discrete element model based upon the inherent anisotropy of the structure of real materials is presented. Samples of materials are assumed to be made up of an assemblage of large numbers of basic elements. It is shown how the behavior of an assemblage of such elements may introduce internal tension into the assemblage even under compressive state of stress. The deformation and failure of materials observed in tests is compared with the results of similar quantities calculated by means of computer. The computer program permits the prediction of any point on the three-dimensional failure envelope. It is shown how the variations in basic materials parameters may produce differences in behavior. Dissert. Abstr.

N71-37555 Catholic Univ. of America, Washington, D.C.
RADIATION FROM THE FORCED HARMONIC VIBRATIONS OF A CLAMPED CIRCULAR PLATE IN AN ACOUSTIC FLUID
Stanley Alper (Ph.D. Thesis) 1970 86 p
Avail: Univ. Microfilms Order No. 70-19556

The acoustic pressure distribution is obtained in a half space bounded by an infinite rigid baffle containing a clamped circular plate which is driven from the in vacuo side by a harmonic force having an arbitrary spatial distribution. A closed form solution is obtained which is valid for both the near and far fields. The Mindlin-Timoshenko plate theory is used, which includes the effects of traverse shear and rotatory inertia, thus yielding a solution valid for moderately high frequencies and/or moderately thick plates. The analysis uses oblate spheroidal coordinates to obtain the solution of the wave equation in the fluid. The resulting solution for the acoustic field is given by an expansion in spheroidal wave functions. Dissert. Abstr.

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N71-37556*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ULTRAVIOLET RADIATION EFFECTS ON THE INFRARED DAMAGE RATE OF A THERMAL CONTROL COATING
James A. Bass Sep. 1971 12 p refs
(NASA-TM-X-65704; X-762-71-391) Avail: NTIS CSCL 20M

An investigation to indicate the rate of damage by ultraviolet radiation to a zinc oxide-silicon coating is discussed. It was determined that the damage is a function of wavelength, intensity, dose, and time. Graphs of the functions to substantiate conclusions are presented. It is shown that the effect of total dose should not be considered constant, but is affected independently of intensity and time. Author

N71-37557*# United Aircraft Corp., East Hartford, Conn.
TRANSIENT MODEL OF HYDROGEN/OXYGEN REACTOR
Final Report, 14 Jan. 1970 - 13 Jan/ 1971

Arthur S. Kesten and Joseph J. Sangiovanni Feb. 1971 57 p refs
(Contract NAS3-13317)
(NASA-CR-120799; UARL-K910962-12) Avail: NTIS CSCL 20M

The utility of a catalytic ignition system to promote hydrogen-oxygen combustion and the limits imposed by the transient response of the system are discussed. The transient behavior of a reactor packed with porous catalyst particles is a function of film and pore diffusion of heat and mass as well as the chemical kinetics of the catalytic reaction. A model has been developed which permits computation of concentration and temperature profiles in the bulk gas phase and within porous catalyst particles are functions of time for given reaction rate expressions. A computer program representing this model has been used to evaluate the relative effects of various design and operating characteristics of typical reactor systems on the transient behavior of these systems. Author

N71-37558# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
CYCLIC HEAT TRANSFER AND STATIC PRESSURE DROP MEASUREMENTS ON PACKED BEDS
I. A. Mumme Mar. 1971 23 p refs
(AAEC/TM-580) Avail: AEC Depository Libraries

Using a cyclic temperature technique, average heat transfer coefficients were determined for gas flow through packed beds. Materials of widely differing thermal diffusivities were used, comprising, in turn, spheres of zircon sand, glass, steel and aluminum. The results agreed with data in the literature obtained by using a conventional heated sphere method. Pressure losses associated with flow of air through the beds were also measured, and the corresponding friction factors were evaluated for a considerable range of Reynolds numbers from 2,500 to 35,000. Author (NSA)

N71-37559*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TLD MEASUREMENTS OF GAMMA HEATING IN HEAVY ELEMENTS
H. J. Reilly, R. A. Robinson, and L. E. Peters, Jr. Cleveland 1971 7 p refs Presented at the Am. Nucl. Soc. Winter Meeting Miami Beach, Fla., 17-21 Oct. 1971
(NASA-TM-X-67938; E-6612) Avail: NTIS CSCL 20M

Measurements and calculations of gamma heating in polyethylene and lead containers were done and compared. The objective was to provide a workable method of getting good values for gamma heating in in-pile experiments containing materials of high atomic numbers. It was inferred that a combination of thermoluminescent dosimeter measurements, using Bragg-Gray theory, with photon transport calculations using the ANISN computer program, would meet this objective. Author

N71-37560*# Pratt and Whitney Aircraft, West Palm Beach, Fla. Research and Development Center.
SPACE STORABLE REGENERATIVE COOLING INVESTIGATION Final Report
8 Oct. 1971 241 p refs
(Contract NAS3-11190)
(NASA-CR-72704; PWA-FR-4000) Avail: NTIS CSCL 20M

An experimental program was conducted to investigate performance and demonstrate regenerative cooling with flox/methane propellants at conditions suitable for a small pump-fed engine. Test hardware evaluated included fixed-thrust injectors, a throttling injector, water-cooled thrust chambers and regeneratively-cooled thrust chambers. The fixed-thrust injectors were tested in both water-cooled and regeneratively-cooled thrust chambers. The throttling injector was evaluated over a 5 to 1 thrust range using water-cooled chambers. Good durability was demonstrated in long duration firings by fixed-thrust and throttling injectors having concentric tube elements. Regenerative cooling was demonstrated at 500 psia chamber pressure and over the 4.2 to 5.5 mixture ratio range. Good thrust chamber durability was obtained with an injector providing low thrust chamber heat fluxes. However, throat erosion occurred with a high heat flux, high-performance injector at combustion-side wall temperatures near the design value (1700 F). These results indicate that a wall temperature limit has been reached, and in future chambers, the throat station design wall temperatures will have to be decreased to obtain good durability. Author

N71-37561*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Space Systems Div.
HANDBOOK OF EXTERNAL REFRIGERATION SYSTEMS FOR LONG TERM CRYOGENIC STORAGE
H. L. Jensen, T. C. Nast, A. P. M. Glassford, R. M. Vernon, and W. F. Ekarn 22 Feb. 1971 304 p
(Contract NAS9-10412)
(NASA-CR-115190; LMSC-A984158) Avail: NTIS HC $8.00/MF $0.95 CSCL 20M

This handbook of external refrigeration systems for long term cryogenic storage was prepared to aid engineer/planner working in the aerospace sciences. It presents data and procedures for conducting selection and optimization studies of cryogenic space borne refrigeration systems. Data are included on the the major elements of the refrigeration system including the refrigerator itself, the cryogenic tankage, the heat absorption system, the heat rejection system, and the power supply. An example case for conducting the trade off studies is presented. The data covers the following parameter ranges: (1) cooling load for 1 to 100 watts, (2) cryogenic tankage for 20 to 280 cu ft, (3) cooling load temperatures for 7.5 to 200 R, and (4) mission duration for 6 to 24 months. Author

N71-37562# Electricity Council Research Center, Capenhurst (England).
A NEW METHOD FOR ELECTRICALLY AUGMENTING COMBUSTION FLAMES
P. D. Johnston and J. Lawton Oct. 1970 11 p refs
(ECRC/N327) Avail: NTIS

A new method of increasing the temperature of a combustion flame is described which uses inductive coupling of electrical energy into the flame as opposed to the usual methods of inserting electrodes and passing a dc or ac discharge through the flame. The limitations of the previous methods are avoided and it is hoped that this new method will lead to a greater use of electricity in the field of chemical and physical processing of materials. Author

N71-37563*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PROCEDURE FOR SCALING OF EXPERIMENTAL TURBINE VANE AIRFOIL TEMPERATURES FROM LOW TO HIGH GAS TEMPERATURES
Herbert J. Gladden and John N. B. Livingood Washington Sep. 1971 28 p refs
(NASA-TN-D-6510; E-6250) Avail: NTIS CSCL 20M

A procedure was developed based on conditions of similarity whereby cooled turbine vane airfoil temperatures measured at low levels of gas temperature can be used to accurately represent both the local and average airfoil temperatures that would be expected at a much higher level of gas temperature. The feasibility of this scaling procedure was verified experimentally in a four-vane cascade capable of operation at gas temperatures and pressures up to 1645 K (2500 F) and 103.4 newtons per square centimeter (150 psia), respectively. A comparison of these scaled airfoil temperatures with experimentally measured airfoil temperatures for the same high temperature conditions is presented. Author

N71-37564# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
KINETICS AND AERODYNAMICS OF FUEL BURNING PROCESSES

B. V. Kantorovich 19 Feb. 1971 198 p refs Transl. into ENGLISH from Tr. Inst. Goryuch. Iskop., Akad. Nauk SSSR (Moscow), 1969 p 1-154
(AD-726575; FTD-MT-24-262-70) Avail: NTIS CSCL 21/2

Published in the collection are materials on the problems of diffusive combustion in turbulent straight line and vortex flows and under conditions of supersonic flow; stabilization of flames; heterogeneous combustion of carbon particles and suspensions; ignition of gas and liquid fuels. Author (GRA)

N71-37668# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THERMAL DECOMPOSITION AND COMBUSTION OF EXPLOSIVE SUBSTANCES: SELECTED CHAPTERS
K. K. Andreev 26 Mar. 1971 426 p refs Transl. into ENGLISH from the book "Termicheskoe Razlozhenie i Gorenie Vzryvchatykh Veschestv" Moscow, Nauka, 1966 p 1-11, 101-259, 294-344
(AD-726573; FTD-MT-24-147-70) Avail: NTIS CSCL 21/2

Much attention in the book is given to experimental works of the recent period conducted under conditions which allow using results of an experiment as material for the creation of a theory and its check. The first chapter is devoted to the general characteristic of basic forms of chemical conversion of explosives and to main types of explosives with respect to composition, chemical structure and capability of stable combustion, and also to detonation. The second chapter examines the slow chemical conversion of explosives under the effect of increased temperature. The third chapter discusses experimental data on the stable combustion of explosives. Basic theories of combustion are examined, a correlation of experimental data with conclusions is produced in reference to various types of explosives (volatile, non-volatile and quick-burning). An account of the theory of the stability of combustion is given in the fifth chapter. Chapter six examines specific cases of the detonation and combustion of explosives in various conditions (intense heating, effect of light and others). Author (GRA)

N71-37669# Northwestern Univ., Evanston, Ill.
THERMODYNAMICS AND RHEOLOGY OF INTERFACES
Scott William Hopke (Ph.D. Thesis) Jun. 1970 174 p refs
Avail: NTIS

An axiomatic formulation of non-equilibrium thermodynamics applicable to systems having singular surfaces which contain mass, internal energy and entropy, is presented. The main results are an energy balance and an entropy inequality. Both surface energy transmission and surface stress effects were considered. Bounding principles for two-phase flow were developed based on Hill's extremum principles. Two examples of the use of these principles are given. The first is an analysis of the knife-edge surface viscometer for power law type surface behavior and Newtonian substrate fluids. The thickness of the knife-edge was considered to be small but non-zero. The second example is that of stratified flow of two immiscible fluids through a tube. The surface viscosity was considered to be negligible. Author

N71-37667# California Univ., Berkeley.
HEAT TRANSFER TO LIQUID HELIUM
Michael Epstein (Ph.D. Thesis) 1970 163 p refs
Avail: NTIS

Heat transfer to liquid helium from horizontal, face-up surfaces of normal and superconducting lead and tin, of PbS, and of GE 7031 varnish was investigated. The nucleate regime, peak nucleate boiling (PNBF), film boiling regime and minimum film boiling flux (MFBF) were studied above the lambda point, and the Kapitza conductance and peak flux were studied below the lambda point. The PNBF for liquid hydrogen on the same surfaces was also investigated between one atmosphere and the triple point. Author

N71-37668# Instituto Nacional de Tecnica Aeroespacial, Madrid (Spain).
DIFFUSION FLAMES AND SUPERSONIC COMBUSTION
Annual Scientific Report No. 1, 1 Apr. 1969 - 30 Mar. 1970
Amable Linan Martinez 23 Feb. 1971 31 p refs
(Contract F61052-69-C-0035; Grant AF-AFOSR-0516-69)
(AD-726662; AFOSR-71-1940TR) Avail: NTIS CSCL 21/2

The research work has been devoted to combustion problems for which it can be assumed that the activation temperature is much larger than any other temperature occurring during the process. Frank-Kamenetskii states in his book, Diffusion and Heat Transfer in Chemical KINETICS, that this condition must be satisfied in order to be able to speak of combustion. Singular perturbation methods based on the smallness of the ratio of a typical temperature to the activation temperature has been used to find analytical expressions for ignition times, reaction zone structures, etc. The specific problems that have been treated by the above mentioned method are covered in this annual report. Author

N71-37669*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPUTER PROGRAM FOR THE TRANSIENT RESPONSE OF ABLATING AXISYMMETRIC BODIES INCLUDING THE EFFECTS SHAPE CHANGE
Lona M. Howser and Stephen S. Tompkins Washington Oct. 1971 82 p refs
(NASA-TM-X-2375; L-7900) Avail: NTIS CSCL 20M

A computer program to analyze the transient response of an ablating axisymmetric body including the effects of shape change is presented in detail. The program, its subroutines, and their variables are listed and defined. The computer input and output, in printed and plotted form, for three sample problems are presented to aid the user in setting up and running a problem with the program. The governing differential equation, the boundary conditions for the analysis on which the computer program is based, and the method of solution of the resulting finite-difference equations are discussed. Author

N71-37670# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorentwicklung.
A CONTRIBUTION TO EXPERIMENTAL THERMAL SHOCK ANALYSIS
W. Lang May 1970 96 p refs Transl. into ENGLISH of German report KFK-1169 Sponsored by US-EURATOM Fast Reactor Exchange Program
(EURFNR-794; KFK-1169) Avail: NTIS

A method for solving problems related to transient thermal stresses is described. The method is based on the experimental determination of frequency response functions and weighting functions for thermal stresses. Duhamel's integral is employed to determine the time curves of the temperatures and thermal stresses generated in a structural component as a result of fast variations of the coolant temperature during reactor operation. Moreover, it provides the means to evaluate the effects of cyclic thermal loads encountered in reactor operation which may cause fatigue of the structure in long-term operation. A representative structural component of reactor technology, which is particularly sensitive to thermal stresses, was equipped with thermocouples and strain gages and investigated in a helium circuit in order to test the proposed method. The validity of the method was demonstrated in a comparison of the results of a real thermal shock on the helium circuit with the results calculated in advance with the help of weighting functions which also had been determined experimentally. Author (NSA)

N71-37671# Carleton Univ., Ottawa (Ontario). Div. of Aerothermodynamics.
GASEOUS DETONATION. 3: THEORETICAL AND EXPERIMENTAL INVESTIGATION OF THE FLOW BEHIND C2H2/O2 DETONATION
Z. El-Rahmy Sep. 1971 126 p refs
(Grant NRC A-4193)
(ME/A-71-3) Avail: NTIS

A method is described which, using the measured pressure

and assuming the flow is time-steady far from the ignition point, in a frame of reference moving with the wave front, will calculate the flow field behind the detonation wave taking into account the wall heat transfer. Wall heat transfer measurements, using a very fast response thermocouple, are in good agreement with those calculated assuming an equilibrium flow field. Gas temperature measurement shows that the measured temperature is on the average 250 K lower than calculated, in the same direction as reported by other investigators, and the difference is believed to be due to the effect of the cool boundary layer.
Author

N71-37572# Carleton Univ., Ottawa (Ontario). Div. of Aerothermodynamics.
GASEOUS DETONATION. 2: HEAT TRANSFER FROM ACETYLENE-OXYGEN DETONATION IN A SHOCK TUBE
Z. El-Ramly and E. G. Plett Sep. 1971 63 p refs
(Grant NRC A-4193)
(ME/A-71-2) Avail: NTIS

Measurements of wall temperature change using a high response thermocouple flush mounted on the inside wall of a shock tube are used to deduce heat transfer rates from the products of combustion to the tube walls. Results for lean, rich and stoichiometric acetylene-oxygen detonations at 25, 50, 100 and 380 mm Hg. initial pressure are reported. These results are compared with computed values of heat transfer rates based on a frozen or equilibrium turbulent boundary layer assumption and for two cases: (1) a steady state C-J detonation flow field with no rarefaction and (2) a flow field calculated using experimentally measured pressure taking into account the heat losses. Theoretical predictions for rich mixtures are also reported for the C-J case. The experimental heat fluxes are found to be in very good agreement with the equilibrium heat transfer calculated using the measured pressure.
Author

N71-37573# Joint Publications Research Service, Washington, D.C.
INSTITUTE OF HIGH TEMPERATURES OF THE USSR ACADEMY OF SCIENCES: MAJOR RESULTS OF SCIENTIFIC RESEARCH WORK, 1970
R. S. Skibitskaya 4 Oct. 1971 93 p refs Transl. into ENGLISH of the book "Institut Vysokikh Temperatur Akademii Nauk: Vazhneyshiye Rezultaty Nauchno-Issledovatelskikh Rabot 1970 Goda" Moscow, Nauka Publishing House, 1971 76 p
(JPRS-54182) Avail: NTIS

Research work constituted: (1) investigations of heat-physical and electrophysical properties of compounds at high temperatures; (2) studies of high temperature processes of heat transfer, mass transfer, and physical gas dynamics; (3) developments and investigations of new heat resistant structural materials; and (4) research on constructing installations for the direct conversion of heat into electric power using MHD generators and other new forms of power plants. An appendix lists articles, books, and inventions published during 1970.
Author

N71-37574 National Lending Library for Science and Technology, Boston Spa (England).
EFFECT OF TEMPERATURE AND OXYGEN PERCENTAGE OF COMBUSTIVE MIXTURE ON THE COMBUSTION OF LIQUID SODIUM
J. C. Malet et al 13 Apr. 1971 4 p Transl. into ENGLISH from Compt. Rend. Acad. Sci. (Paris), v. 271, 2 Nov. 1970 p 1131-1134
(NLL-RISLEY-Trans-2115-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A description is given of the development of the ignition range of sodium characterized by blue emission, under the effect of temperature and the oxygen percentage of the combustive mixture. The range remains separate from that of yellow flames when the temperature rises. An X-ray analysis of the combustion residues showed the formation of the monoxide Na20 and the peroxide Na202 in both cases.
Author

N71-37575 National Lending Library for Science and Technology, Boston Spa (England).
TEMPERATURE MEASUREMENT
V. I. Subbotin et al 1 Jun. 1971 12 p Transl. into ENGLISH from the book "Heat Transfer in Boiling Metals in Natural Convection Conditions" p 40-52
(NLL-Risley-Trans-2184-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL Photocopy Coupon

A few specific aspects of temperature measurement in heat transfer experiments with boiling metals were examined. Particular attention was given to the determination of the heat emitting surface temperature in pipes heated by an electric current. The use of thermocouples embedded in the pipe wall was regarded as the main method of measuring the temperature. The problems considered included: correction for the temperature drop in the wall and distortion of the temperature field around the thermocouple; liquid and wall temperature variations with time; and variation in thermocouple characteristics during operation.
J.G.M.

N71-37576 National Lending Library for Science and Technology, Boston Spa (England).
STABILISATION OF TURBULENT DIFFUSION FLAMES
R. Guenter 2 Mar. 1971 10 p refs Transl. into ENGLISH from Chem.-Ingr-Tech. (Heidelberg), v. 42, no. 3, Feb. 1970 p 105-108 In GERMAN and ENGLISH
(NLL-M-20389-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Factors influencing the stabilization of diffusion flames are discussed. Two effects which must be considered are the degree of turbulence and the nature of the intermittency. Subjects presented are: (1) the effect of turbulence, (2) energy ignition conditions, (3) balance of velocities, (4) flow and flame velocity in the stability range.
Author

N71-37577 Pennsylvania State Univ., University Park.
HYDRODYNAMICS OF COCURRENT COUNTERGRAVITY SOLIDS TRANSPORT FOR LIQUID-FLUIDIZED HEAT EXCHANGERS
Ronald Joseph Kopko (Ph.D. Thesis) 1969 273 p
Avail: Univ. Microfilms Order No. 70-13848

A pilot plant study was made to develop a cocurrent, counter-gravity, particulate solids-water transport system for application to liquid-fluidized heat exchangers. Equations were developed to predict solids transport pressure drop and were evaluated using experimental data. In addition, system energy requirements were calculated and analyzed for each of three solids feeder systems. The pilot plant equipment included a 13-foot long, vertical, 2.43-inch I.d. stainless steel lift line to which various solids feeders were attached. The feeders studied were a water-jet ejector, a water-jet eductor, and a multiple-jet system. The solids feeding characteristics of each solids feeder-particulate solids combination were described as a function of system variables. It was shown that the volume fraction of solids transported in the lift line was as large as 0.26. Based on system energy considerations the multiple-jet feeder was the most efficient, having provided a maximum solids transport rate of 924 pounds per minute per horsepower input when operating with 1/8-inch iron shot.
Dissert. Abstr.

N71-37578 California Univ., Los Angeles.
EFFECT OF ARBITRARY WALL CONDUCTION AND RADIATION ON FREE CONVECTION IN A CYLINDER
Wi-Mo Sun (Ph.D. Thesis) 1970 211 p
Avail: Univ. Microfilms Order No. 70-19900

Solutions are presented to eigenvalue problems related to the thermal instability of a viscous fluid heated from below in a completely enclosed cylinder (circular or rectangular cross sections) with arbitrarily-conducting side walls. Wall conduction and wall radiation parameters are formulated to account for the total wall conduction effect upon the onset of natural convection in confined cylinders. It is found that the critical Rayleigh number can be affected by the total wall conduction, up to a factor of

three for a circular cylinder, and without limit for a rectangular cylinder. For large height-to-diameter circular cylinders and large height-to-separation and width-to-separation rectangles, exact solutions are presented. Approximate solutions for predicting the initiation of convection in intermediate-sized cylinders with finite conducting side walls are analytically constructed, and experimentally validated. The predicted and measured minimum initiation Rayleigh numbers are found to agree within ten percent. Dissert. Abstr.

N71-37579 Louisiana State Univ., Baton Rouge.
A DIGITAL SIMULATION OF A ONCE-THROUGH SUPERCRITICAL STEAM GENERATOR
Alfred Julius Flechsig, Jr. (Ph.D Thesis) 1970 385 p
Avail: Univ. Microfilms Order No. 70-18529

The simulated plant is rated at 560 MW, 3,980,000 lb/hr steam flow and a superheater outlet pressure of 3600 psig and temperature of 1005 F. It has one stage of reheat to 1005 F. A lumped parameter system was utilized in the development of the simulation equations. Twenty-three lumps are included. Twelve of these lumps consider the fluid flow dynamics and the heat transfer characteristics through the walls in a dynamic fashion while the remaining 11 lumps in the model are considered in a heat balanced fashion. The problem was solved in a nonlinear fashion and the method of solution of the process differential equations used is the Runge-Kutta third order method. For the control system equations the method of integration used is the trapezoidal rule. The fundamental equations that are used in the process are considered and developed. The various component parts of the supercritical once-through steam generator are described. Dissert. Abstr.

34 GENERAL

Includes information of a broad nature related in industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N71-37580*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
JOINT ASSESSMENT AND MANAGEMENT EVALUATION SYSTEM
Preston T. Farish and Richard J. Stein 1 Jul. 1971 41 p
(NASA-TM-X-64537) Avail: NTIS CSCL 05A

An optimized task arrangement to integrate development functions into an organizational structure is presented in this report. Author

N71-37581*# Concept Applications, Ltd., Hempstead, N.Y.
DESIGNER'S HANDBOOK: ENVIRONMENTAL PLANNING FOR GROUP STABILITY
Henry E. Bender and John Fracchia Aug. 1971 64 p refs
(Contract NASS-10998)
(NASA-CR-115180) Avail: NTIS CSCL 05K

Guidelines and recommendations for habitability design are formulated to facilitate individual and group stability. These findings are based on reviews of previous studies involving persons in various terrestrial environments. Considerations were given to the NASA group model and properties of such a group. Author

N71-37582# Australian Post Office Research Labs., Melbourne.
ADVANCED TECHNIQUES SECTION Annual Report, 1 Jul. 1969 - 30 Jun. 1970
A. J. Seyler, ed. Apr. 1971 110 p refs
(Rept-6541) Avail: NTIS

A collections of individual contributions by the professional staff of the Australian Post Office Research Laboratories are presented. The period of the research projects is from July 1969 to June 1970. General information is also provided on the works program, staff matters, and publications by the staff. Author

N71-37583*# Washington Univ., St. Louis, Mo.
PROGRAM ON APPLICATION OF COMMUNICATIONS SATELLITES TO EDUCATIONAL DEVELOPMENT. COMPUTER-BASED INSTRUCTION: A BACKGROUND PAPER ON ITS STATUS, COST/EFFECTIVENESS AND TELECOMMUNICATIONS REQUIREMENTS
Jai P. Singh and Robert P. Morgan 10 Apr. 1971 40 p refs
(Grant NGL-26-008-054)
(NASA-CR-122945; Rept-71-1) Avail: NTIS CSCL 05B

Background information is presented on computer-based instruction (CBI), its status, cost-effectiveness, and telecommunications requirements. In this latter regard, particular attention is given to the role of telecommunications, and particularly communication satellites, in large-scale totally and partially centralized CBI systems and in extending CBI services to rural, small, and less-affluent communities and schools. In slightly over twelve years since its inception, CBI has shown promise of being more cost-effective than traditional instruction for certain educational applications. Pilot experiments are underway to evaluate various CBI systems. Should these tests prove successful, a major problem confronting advocates of large-scale CBI utilization is the conflict between the organization of the traditional school system and optimal methods of utilizing computer-based instruction. Author

N71-37584*# Washington Univ., St. Louis, Mo.
PROGRAM ON APPLICATION OF COMMUNICATIONS SATELLITES TO EDUCATIONAL DEVELOPMENT. AN INSTRUCTIONAL SATELLITE SYSTEM FOR THE UNITED STATES: PRELIMINARY CONSIDERATIONS
James R. DuMolin and Robert P. Morgan 16 Jul. 1971 39 p refs
(Grant NGL-26-008-054)
(NASA-CR-122946; Rept-71-2) Avail: NTIS CSCL 05B

Based upon educational, social, political and other considerations, an instructional satellite system, AVSIN (Audio-Visual Satellite Instruction), is hypothesized which represents one possible organizational and administrative arrangement for delivering large amounts of quality software to schools and learning centers. The AVSIN system is conceived of as a cooperative public-private sector effort in which a nonprofit instructional satellite corporation controls the satellite but in which software is made available to schools on a competitive basis. Using AVSIN as a point of departure, other alternative organizational schemes and the possible future role of existing organizations involved in public and instructional television are discussed. A more detailed study of technical and economic feasibility as well as further exploration of alternatives to such a system remain to be performed before firm conclusions concerning the AVSIN system can be reached. Long-range social and political implications for U.S. education are assessed. Author

N71-37585# New South Wales Univ., Kensington (Australia).
RESEARCH AND PUBLICATIONS, 1970
1970 188 p refs
Avail: NTIS

A summary of research and publications for 1970 is presented from various faculties, schools, and departments in the University of New South Wales. Subjects covered include: applied science, arts, biological science, engineering, medicine, physics, chemistry, and mathematics. J.M.

N71-37586# National Bureau of Standards, Washington, D.C.
A HISTORY OF THE METRIC SYSTEM CONTROVERSY IN THE UNITED STATES: US METRIC STUDY
Aug. 1971 312 p refs

(NBS-SP-345-10) Avail: SOD $2.25

The debate between 1790 and 1968 on the question of whether or not the United States should adopt the metric system of weights and measures is described. Legislative activities with respect to weights and measures and campaigns for and against adoption of the metric system are reviewed. Significant investigations of the question by both public and private bodies are highlighted, and an extensive bibliography is included. Author

N71-37587# Electronic Systems Div., Bedford, Mass.
PERSONNEL SUBSYSTEM MANAGEMENT OF ELECTRONIC SYSTEMS
William H. Hendrix May 1971 70 p refs
(AD-726552; ESD-TR-71-168) Avail: NTIS CSCL 05/9

Personnel subsystem management within the Electronic Systems Divison is presented. Presentation includes a description of the functional areas of the personnel subsystem, and those events which lead to an effective personnel subsystem within the system acquisition process. The personnel subsystem requirements for each phase of the system acquisition life cycle are presented as an integral part of the system management process. Author

N71-37588# Navy Experimental Diving Unit, Washington, D.C.
INDEXED RETRIEVAL SYSTEM FOR NAVY EXPERIMENTAL DIVING UNIT RESEARCH AND EVALUATION REPORTS Final Report
Hugh T. Beatty, Thomas E. Berghage, and Donald R. Chandler 1 Jun. 1971 79 p refs
(AD-726696; NEDU-RR-6-71) Avail: NTIS CSCL 05/2

To update and streamline information retrieval at the Navy Experimental Diving Unit (NEDU) a computerized KWIC index system was developed. The KWIC system permits the user to retrieve NEDU research and evaluation reports by report number, author, and/or keyword in title. The KWIC computer programs developed by IBM were so successful in this application that they are now being applied to all of NEDU microfilmed research files. Author

N71-37589# Defense Dept., Washington, D.C.
LIFE CYCLE COSTING PROCUREMENT GUIDE Interim Report
Jul. 1970 119 p
(AD-726978; LCC-1) Avail: NTIS; SOD $1.50 CSCL 05/1

Life Cycle Costing (LCC) is an acquisition or procurement technique which considers operating, maintenance, and other costs of ownership as well as acquisition price, in the award of contracts for hardware and related support. The objective of this technique is to insure that the hardware procured will result in the lowest overall ownership cost to the government during the life of the hardware. This interim guide is limited to the necessary guidelines for implementing LCC in the procurement of less than a complete weapon system in a competitive environment where the minimization of life cycle cost is the primary economic objective. Author

N71-37590# Committee on Foreign Relations (U. S. Senate).
CONVENTION FOR THE SUPPRESSION OF UNLAWFUL SEIZURE OF AIRCRAFT
Richard Nixon Washington GPO 1971 19 p
Avail: US Capitol, Senate Document Room

The convention for the suppression of unlawful seizure of aircraft, signed at the Hague on 16 December 1970 is presented with an article by article analysis. J.M.

N71-37591# Council on Environmental Quality, Washington, D.C.
THE PRESIDENT'S 1971 ENVIRONMENTAL PROGRAM
Mar. 1971 309 p refs
Avail: SOD $2.25

The 1971 proposals made by the President of the US to Congress on environmental pollution and control are discussed. The proposals include measures to strengthen pollution control programs, control emerging problems, promote environmental quality in land use decisions, establish environmental control institutes, and expand international cooperation. E.H.W.

N71-37592# RAND Corp., Santa Monica, Calif.
NEW DEVELOPMENTS IN TRANSPORATION ANALYSIS: EVALUATION OF MIXES OF MODES IN ALTERNATIVE REGIONAL ENVIRONMENTS
Frederick S. Pardee Jul. 1970 29 p refs
(P-4425) Avail: NTIS

The application of recent methodological research to the analysis of transportation problems was investigated to measure incremental benefits to be derived from providing transportation services to a region. The geographical region chosen to illustrate the application of the methodology is the area from Washington, D.C. to New York City, and incorporates counties extending west to the Apalachian Mountains. Methods to estimate user, operator, and societal impacts when the total system mix operates within a complex network of future regional environments are included. F.O.S.

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NEW NASA PUBLICATIONS

Lunar Photographs from Apollos 8, 10, and 11 (NASA SP-246)

An atlas containing a comprehensive sampling of the photographs from the first three Apollo lunar missions. Included are photographs of almost every type of feature and terrain that exists on the surface of the Moon. More than 150 selected shots, with descriptive captions, are included. Of these, nearly half are in color. Because the terminator—the line of demarcation between darkness and sunlight—was at most a few degrees west of the zero meridian during each of the three missions, the photography is primarily of the eastern hemisphere of the Moon. Consequently, the atlas contains a wealth of lunar far-side pictures. *Clothbound.* 130 pp. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for $4.00.

Astronautics and Aeronautics, 1969: Chronology on Science, Technology, and Policy (NASA SP-4014)

This is the annual volume compiled by the Library of Congress and issued by the NASA Historian that utilizes newspapers, magazines, speeches, and government and industry announcements to document activities in the aerospace and aeronautical fields. Special attention is devoted in this volume to worldwide reaction to the first manned landing on the Moon. Appendixes list major NASA launches during the year as well as documentation from open sources of launches of all satellites, space probes, and manned space flights. An extensive index is included. *Paperbound.* 544 pp. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for $2.25.

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